GOLDEN RULES OF DIETETICS

BENEDICT

Medical Guide and Monograph Series

GOLDEN RULES OF DIETETICS

THE GENERAL PRINCIPLES AND EMPIRIC KNOWLEDGE OF HUMAN NUTRITION; ANALYTIC TABLES OF FOODSTUFFS; DIET LISTS AND RULES FOR INFANT FEEDING AND FOR FEEDING IN VARIOUS DISEASES.

BY

A L BENEDICT, A.M., M.D.
BUFFALO.

Member of American Academy of Medicine, and of American Gastroenterological Association, Etc. Author of Practical Dietetics.

C. V. MOSBY
Medical Book and Publishing Company
St. Louis

1908

Nixon-Jones Printing Co.
St. Louis, Mo.

THIS BOOK IS DEDICATED TO MY MOTHER

GRACIA S. SMITH BENEDICT

NOT ONLY AS A MARK OF THE LOVE AND RESPECT WHICH
NO PARENT COULD DESERVE MORE HIGHLY, BUT
IN RECOGNITION OF HER INVALUABLE ASSIST-
ANCE IN THIS AND OTHER WRITINGS.

PREFACE.

It is never safe to use the word *never* in medical writing, and always unwise to use the word *always*. Thus it is impossible to reduce the manifold problems of dietetics to a rule of thumb which can be followed literally, in all instances, without regard to environment, personality or circumstance. At the same time, it is both possible and convenient to have presented, the general principles and details of the science and art of dietetics, in the form of succinct rules for guidance, although the writer has not hesitated to depart from this plan whenever a table or summary would permit the condensation of related facts which would otherwise appear in an isolated and arbitrary way, without a hint of their mutual bearing upon one another.

Bearing in mind the needs of the active practitioner of medicine, the writer has endeavored to avoid purely scholastic scientific research which cannot be adapted to practical ends, and, on the other hand, the short-sighted so-called "practical" method of presenting facts in an empiric manner without the scientific basis which alone enables a grasp of their true significance and a proper adjustment to individual requirements. While endeavoring to supply the just demand for originality and to give due credit for actual citations of the work of others, the writer has felt that, in any systematic medical work, personal opinion must be kept within bounds while a liberal draft is made on the general fund of medical experience for which it is impossible to give credit, except in this preliminary statement.

CONTENTS

CONTENTS—CONTINUED.

CHAPTER I.

PHYSIOLOGIC CHEMISTRY.

Composition of the Body.

The higher mammalian bodies—and the same applies with some qualifications to most animals and plants—are composed of fifteen essential elements, in various combinations. Other elements are occasionally present from medication, poisoning of a degree insufficient to interfere with life, and accidental impregnation with minerals of the particular locality. Arsenic, bismuth, copper, mercury, bromin, lithium are the commonest examples. Persons living near the sea have more iodine in the thyroid than those living inland.

Elementary Composition of Human Body.
(After Moss.)

	Per cent.	Pounds.
Oxygen	.62432 =	92.4
Hydrogen	.09864 =	14.6
Carbon	.21351 =	31.6
Nitrogen	.03108 =	4.6
Phosphorus	.00945 =	1.4
Calcium	.01891 =	2.8
Sulphur	.00162 =	.24
Chlorin	.00081 =	.12
Sodium	.00081 =	.12
Iron	.00013 =	.02
Potassium	.00229 =	.34
Magnesium	.00027 =	.04
Fluorin	.00013 =	.02
Silicon		Trace
Iodin		Trace
Total	1.00197 =	148.30

Carbon, hydrogen and nitrogen are not at all assimilable in the elemental form and act only mechanically when introduced.

Elemental phosphorus and sulphur have a medicinal, the former a toxic action. Small proportions, however, are oxidized into the form of phosphates and sulphates, respectively. Inorganic compounds act medicinally, and to form inorganic constituents of bone, etc., and to aid in various osmotic processes. Possibly small proportions are further altered to form organic combinations. As constituent parts of protoplasm, they must be mainly, perhaps entirely, ingested in similar organic compounds.

Oxygen is regularly introduced into the body in large amount both as an essential constituent of organic foods and as an element by respiration. In the latter form, probably always with the assistance of enzymes, it oxidizes all forms of organic components of the body, but probably always destructively rather than constructively.

All the other elements might, barring corrosive action, be administered in the elemental state, and would, thereupon, form inorganic and organic combinations in the alimentary canal similar to what would be formed in vitro with the same available substances for combination. Iron can certainly be assimilated in this way, though not so readily as from organic compounds. In most instances, however, all of these elements are best given as salts or as organic compounds.

Excepting the inevitable reactions in the alimentary canal, which have no vital significance, it may be stated that no element can be used as a nutriment in the elemental state.

Proximate principles are chemic compounds of which the body is composed and into which it is theoretically—but not analytically—separable without chemic change. They may be classified as follows:

Organic	Nitrogenous	Proteids	CHON Proteids CHONSP Proteids
		Albuminoids	Purin compounds
	CHO Compounds	Carbohydrates	Polysaccharids Disaccharids Monosaccharids
		Fats and Oils	Oleate of glycerole Palmitate " Stearate "
Organic Modified by Inorganic Combination			Haemoglobin Lecithin Iodothyrin
Inorganic	Water		
	Salts	Calcium Magnesium Potassium Sodium Ammonium	Chlorids Sulphates Phosphates (including acid and neutral H-salts Uric, Hippuric and other radicles produced by catabolism or by fermentation

Disregarding unassimilated ingesta and excreta, including, under these heads, the gases of the blood, etc., a very lean human body is composed of proximate principles in the following proportions.:

Water..............	67%	
Proteids.............	18%	
Fats...............	3%	(Ordinarily 9—23%, on the average 16%, in obesity 50%.)
Haemoglobin..........	2%	(More than half in blood, remainder in muscle plasma, spleen, liver, etc.)
Non-proteid nitrogenous matter and glycogen..	3%	
Calcium phosphate....	4%	
Other minerals.........	3%	

These proportions are, of course, subject to great variation, especially in regard to fat, which correspondingly reduces the proportion of the remaining constituents.

Nutritive Requirements.

While the requirements of the body are necessarily determined by its constitution, there is no correspondence of quantitative relations, and the qualitative relations are disturbed by various factors. Thus the elemental analysis of the body throws practically no light on its requirements in foods and the analysis by proximate principles, very little. This paradox is due to two main reasons. First, there is a great difference in the rapidity with which different ingredients are wasted. Water and soluble salts pass through the body—not in the sense of a direct passage through the alimentary canal—quite rapidly. Insoluble salts, as calcium phosphate, etc., in bone, are wasted very slowly, and the silicates, mainly represented in dental enamel, are scarcely at all replaceable. Secondly, foods serve two quite distinct purposes, the replacement of tissue waste and the furnishing of heat and energy. The waste of proteid tissues is quite slow and uniform, depending very slightly on differences of activity. Conversely, carbohydrates never strictly form any part of the body, though present to the amount of two or three hundred grams as a reserve supply of energy in the form of glycogen and as a supply in process of use, in the form of dextrose in the blood. Yet nearly four hundred grams a day are required under normal conditions. Fats, although forming 16% of the average, well nourished body and practically never falling below 3%, even in starvation, are not necessary at all in the food, as they may be produced both from proteids and carbohydrates. It should be remembered also that however useful as a reserve supply of nutriment and as packing, and to prevent rapid loss of heat by radiation, they do not, any more truly than carbohydrates, form an essential part of the body.

Thus, for practical purposes, the nutritive requirements

must be determined by actual empiric observation. Subject to considerable variation, they are as follows:

Proteids, 50.—125 grams.	At least $\frac{2}{3}$ gram must be given for every kilo of body weight to prevent consumption of tissues. On the other hand, unless necessitated by the failure to assimilate fuel-foods, more than 125 grams is objectionable on account of producing toxic waste products.
Fats, 0.—150. grams.	Ordinarily about 50—80 grams may be used.
Carbohydrates, 80.—400 grams.	Less than 80 grams requires so much destruction of fats and proteids that fatty acid intoxication is imminent.
Albuminoids.	These are produced by the partial decomposition of proteids, though some hold that some nuclein compounds are required. Gelatin may be used as a fuel food, to the amount of 100 grams a day, but not indefinitely.
Lecithin, iodothyrin, etc.	The exact amount needed or whether any is needed, has not been determined. Enough is included in any average diet.
Haemoglobin.	The small quantity contained in an allowance of 50 grams of meat daily is sufficient and probably, so long as 10 centigrams of iron is furnished in any form, the normal body can anabolize it into haemoglobin.

Water, 2000—3000 c.c.	About 1000 c.c. is contained in an ordinary so-called *dry* diet. On the other hand, about 1000 c.c. should be given as water.
Sodium chlorid, 10—20 grams.	Ordinarily, 20 or even 30 grams produce no appreciable harm. While some claim that the amount contained in unsalted meat, vegetables, etc., is sufficient, about 10 grams additional is craved by most human beings and a proportionate amount by the higher quadrupeds.
Other mineral salts.	Ordinarily supplied in sufficient amount in the diet.

Antiscorbutic principle.	Whether this consists essentially in potassium or in vegetable acids, is disputed. At any rate, a small quantity of raw milk or of fresh or cooked fruit or vegetables, is required.

Cellulose and other indigestible material is not theoretically required, but must be taken to the amount of 50 grams or thereabouts, a day, to insure proper peristalsis and, indirectly, to maintain health.

Processes of Nutrition.

The processes of nutrition are:

1. Ingestion, for which may be substituted more or less satisfactorily, rectal injection, inunction of fats, subcutaneous injection of salts, dextrose, etc., in solution, as well as gavage, or feeding through a fistula;

2. Digestion, which does not apply to inorganic matters nor to organic foods already in the state suitable for absorption. Digestion is commonly divided into mechanic, including the comminution and softening of food, and chemic;

3. Absorption, through animal membrane, into the blood or lymph vessels;

4. Assimilation, which literally implies that the food is rendered like the body itself, and which, therefore, refers strictly only to the utilization of certain foods to repair or form tissue; the term is, however, usually extended to indicate the final utilization of any organic, or even inorganic, substance.

Following assimilation, after a shorter or longer period, there is—

5. Catabolism, which, like digestion, applies only to certain organic substances and which usually occurs in successive steps, often involving several organs:

6. Elimination of ultimate waste products, by the skin, lungs, kidneys and, to some extent, through the liver directly or even through the alimentary mucous membrane, independently of the liver. Substances which escape absorption in the alimentary canal are *wasted* rather than *waste* products.

Chemic digestion occurs as follows:

1. Proteids. In the stomach, a variable fraction is converted into acid albumin and then into albumoses and peptones, and part into amido-acids under the joint action of hydrochloric acid and pepsin. When the meal is very small and liquid or pultaceous, as after unusually careful mastication, probably nine-tenths of the proteid is digested in the stomach. On the other hand, when the meal is large, and the proteid is contained in large masses as of meat, milk curds, bread, etc., probably not more than a tenth is digested.

   The pancreatic ferment, trypsin, when activated by a duodenal secretion (not a ferment) digests most of the

remainder of the albumin, into substances similarly named, except that alkali-albumin is substituted for acid albumin, but which are not exactly identical with those produced by peptic digestion.

2. Albuminoids, etc., seem to be digested analogously to proteids, but the exact nature of the process is not so well understood.

3. Carbohydrates. Cellulose is not digested at all by human ferments, but is decomposed into methane and hydrogen, carbon dioxid and water, by bacteria, in the intestine. Being indigestible and innutritious, it is commonly excluded in dietetics, when the term carbohydrate is used without qualification.

Starch, when cooked so as to disintegrate the cellulose envelopes of the granules, is digested by ptyalin of the saliva, into maltose, a disaccharid, through intermediate stages of dextrins. Dextrins, as in bread crust, are, of course, also digested into maltose. With ordinary, imperfect mastication and insalivation, ptyalin digestion does not amount to much, although it proceeds in the stomach for an hour or so, till a considerable degree of hydrochloric acidity stops it. Certain rodents have a very powerful salivary ferment which will digest the raw starch of nuts, grains, etc.

Whatever cooked starch and dextrin is left after salivary digestion—usually a large majority of what has been taken—as well as any raw starch—particularly in bananas—is similarly transformed by amylopsin of the pancreas, which is about 40 times as strong (or possibly as concentrated) as ptyalin.

The disaccharids, saccharose (cane, maple and beet sugar), lactose (milk sugar) and maltose, as ingested or prepared by the salivary and pancreatic ferments, are split into monosaccharids by an invert ferment of both the stomach and intestine.

The monosaccharids, dextrose, levulose and galactose are utilizable as such, though, apparently, large amounts

only of the first can be absorbed without producing a waste through the kidneys.

4. Fats are split to a very slight degree in the stomach. In the intestine they are broken up into fatty acids and glycerole, under the action of steapsin of the pancreas. The former unite with the alkaline carbonates of the bile, pancreatic and intestinal juices, to form soaps, the latter with water to form glycerin.

Absorption: Proteids and carbohydrates are absorbed mainly into blood capillaries, whence they reach the liver by the portal vein; fats by lacteals, whence they reach the innominate vein through the thoracic duct. Part of each takes the opposite course. Peptones are apparently reconverted into an albumin during absorption; at any rate, artificial peptones directly introduced into the circulation are toxic. Fats also seem to be recombined during absorption and, possibly, are further elaborated in the mesenteric lymph nodes. Carbohydrates, absorbed as dextrose and to some extent as the other monosaccharids, are converted by the liver into glycogen and thus stored in the liver, to be reconverted into dextrose (apparently even if the glycogen has been derived from one of the two other monosaccharids) and are fed into the blood so as to maintain as nearly as possible the proportion of 9/10 per mille. Secondary minor reserve stores of glycogen are also found in glands and muscle.

Soluble substances generally are absorbed without digestion, through the alimentary mucous membrane, but raw albumin and sugars not taken in too great amount, are changed to the appropriate forms. If absorbed in too great quantity, they are eliminated in the urine. So, too, when dextrose accumulates in the blood in too great quantity, as in diabetes, the excess is eliminated.

The stomach is not adapted to absorption, even of water, though doubtless some absorption occurs through it. Owing to secretions, the alimentary contents become more watery in passing through the stomach and upper small intestine, so that no great

net amount of absorption of water occurs till the caecum and ascending colon are reached.

In addition to digestive changes, all kinds of organic foods are more or less attacked by bacteria and yeasts, especially in the bowel. The present opinion is that bacterial digestion does not assist in the preparation of nutriment for the body, and that it is rather a waste.

Under normal conditions, no appreciable amounts of proteid or carbohydrate should appear in the faeces, except in insoluble masses such as unchewed peas, beans, corn, dense tendon ends, lumps of vegetable tissue, etc. Fat, on the other hand, is always wasted in appreciable amounts, about 10% on a normal diet containing 50—100 grams, relatively more for larger or for very small amounts.

Practically nothing is known of the digestion, absorption and assimilation of lecithin, iodothyrin, etc.

Catabolism and Excretion. Dextrose, representing carbohydrates, is oxidized in the blood (or cells) mainly under the influence of a glycolytic ferment whose source, at least for the most part, is probably an internal secretion of the islands of Langerhans in the pancreas. At least, many cases of diabetes are definitely shown to have a lesion of these islands. The products are carbon dioxid and water. Oxidation without a ferment is too slow to account for the physiologic process.

The exact catabolism of proteids is not known. The nitrogen is mainly eliminated as urea, formed mainly, at least, in the liver. In grave forms of diabetes, part of the proteid molecule is transformed into sugar, and since fat may be deposited on a proteid or carbohydrate diet, it is obvious that part of the proteid molecule may be either indirectly or directly transformed into fat. Creatinin is undoubtedly derived from creatin which is formed in muscles from proteid, either of the food itself directly, or more probably of the muscle, indirectly derived from food.

Nucleins yield various purin bodies, of which uric acid is the best known. Whether, as was formerly taught, uric acid is also derived from proteids directly, as the resnlt of iucomplete oxidation into urea, is not positively known.

Fats, like carbohydrates, yield carbon dioxid and water as end products but also intermediate products consisting of fatty acids, and, under some conditions, acetone. The oxidation of fats unquestionably requires a ferment whose source is unknown, though the obesity of eunuchs and of women after the menopause or oophorectomy, suggests an internal secretion of the sexual glands.

Of the waste products of the body, the water is eliminated by the skin, kidneys and lungs, and also a small amount by the bowel; the normal quantitative relations are disturbed by diaphoresis and, to a less degree, by diuresis and diarrhoea. Nearly all of the carbon dioxid is eliminated by the lungs, but small amounts are found in all excretions. The saline material that has been absorbed is eliminated mainly through the urine, but considerable is also eliminated by the skin. Nitrogenous waste is eliminated to the extent of about 6/7 through the kidneys, most of the remainder and the most toxic portion, is eliminated through the liver and bowel, minute quantities through the lungs and skin, through the latter mainly in cases in which the kidney function is disturbed.

Under ordinary diet, about half of the faeces consists of undigested and unutilized ingesta, including strictly indigestible material, and about half of shed epithelium and mucous, more or less altered, and of waste matter in the strict sense.

CHAPTER II.

DAILY REQUIREMENTS OF THE HUMAN BODY IN CALORIES AND IN TERMS OF PROTEID, CARBOHYDRATE AND FAT.

Heat and energy are mutually convertible and are measured in units termed calories, each calorie representing the heat necessary to raise one kilogram of pure water, one degree centigrade, in temperature.

The human body, in a state of physical rest, but functionally active, requires daily about 30 calories per kilogram, or 2100 calories for the standard man of 70 kilograms or 154 pounds. As differences in weight depend largely on nearly quiescent tissues, such as bone, connective tissue and fat, it is practically unnecessary to make allowance for moderate variations from the standard. Moderate physical activity, as for a healthy business or professional man, requires about 35 calories per kilogram or a total of about 2500; hard labor requires 40 or more calories per kilogram, or a total of 3000 up to 4000.

The heat and energy required by the body are furnished by the oxidation of organic foods:

Carbohydrates	oxidized	in	the	body	yield	4.1	calories	per	gram.
*Proteids	"	"	"	"	"	4.9	"	"	"
Fats	"	"	"	"	"	9.3	"	"	"
Alcohol	"	"	"	"	"	7.1	"	"	"
Gelatin	"	"	"	"	"	4.1	"	"	"

As a matter of scientific empiricism, it is known that the body requires daily about 1/1000 of its weight in proteid or 1 gram per kilogram, to make good the inevitable waste of tissue. The extreme lower limit of proteid requirement has been set by

* Stated at 4.1 calories per gram, for practical purposes, by most recent authorities.

Chittenden at a trifle less than 50 grams. Most authorities agree that 100 grams may be taken without harm and many believe that this amount is advisable to afford a margin of safety. Any considerable series of active adults, allowed to select food according to their natural appetite, will take 100—125 grams of proteid a day.

While in diabetes and various other conditions, it is often advisable to give relatively large amounts of proteid, the normal upper limit may be set at about 150 grams.

Fats and carbohydrates are, to a certain degree mutually vicarious. Fatty food is apparently not at all necessary to maintain a state of health or even to allow the deposition of fat. It is, however, difficult to select a diet list that shall contain less than 10 grams of fat for the day's ration. On the other hand, the physiologic provisions for the digestion of fat are not so perfect as for proteids and carbohydrates, and it is practically impossible to give more than 150 grams a day without marked loss of fat in the bowel, diarrhoea, disturbance of digestion and even toxic action from incompletely catabolized fat.

The lower limit for carbohydrates may be set at 80 grams for, if less is taken, acid intoxication is imminent. The extreme upper limit may be set at 920 grams, determined arithmetically as follows: Suppose the maximum requirement of calories, 4000, the minimum of fat, zero, and the minimum of proteid, 50 grams. This amount of proteid at 4.9 calories per gram, yields 245 calories, leaving 3755 calories to be produced by carbohydrates, at 4.1 calories per gram. It is, of course, undesirable that a man at heavy labor should take the minimum either of proteid or fat. Under ordinary conditions, the carbohydrates should lie between 250 and 500 grams.

While the number of calories required varies according to the amount of exercise, temperature, etc., the waste of tissues is practically constant, unless affected by pathologic conditions, such as starvation, the perverted catabolism of diabetes, etc. Hence, the laborer requires little more proteid than the brain worker, or the idler.

The standard diet for a man at light exercise may be stated as follows:

Proteid. 100	grams	$\times 4.9 =$ 490	calories.
Fat. 70	"	$\times 9.3 =$ 651	"
Carbohydrates. 330	"	$\times 4.1 =$ 1353	"
Total energy.		2494	"

The proteid may, however, vary between 50 and 125 grams, and the fat between 30 and 100 grams, with corresponding variation in the carbohydrates to make up the required total of calories.

On a low proteid basis, the standard diet may be stated as follows:

Proteid. 50	grams	$\times 4.9 =$ 245	calories.
Fat. 80	"	$\times 9.3 =$ 774	"
Carbohydrate 400	"	$\times 4.1 =$ 1640	"
Total energy.		2629	"

According to Rubner, the caloric value of proteids and carbohydrates are equal, 4.1 calories per gram. Thus, so far as the maintenance of heat and energy are concerned, they may be used interchangeably, and 610 grams of both will support the body. Since the caloric value of fats is 9.3 calories per gram every ten grams of fat used replace not quite 23 grams of proteid and carbohydrate.

AMOUNT OF ORGANIC NUTRIENTS REQUIRED TO YIELD 2500 CALORIES.

Grams of carbohydrate needed to supplement above number of grams of proteid and number of grams of fat in extreme right column.

50	60	70	80	90	100	110	120	130	140	150 Grams of Proteid Daily.	Grams of Proteid and Carbohyd.	Grams of all Organic Foods.	Grams of Fat.
560	550	540	530	520	510	500	490	480	470	460	610	610	0
537	527	517	507	497	487	477	467	457	447	437	587	597	10
514	504	494	484	474	464	454	444	434	424	414	564	584	20
492	482	472	462	452	442	432	422	412	402	392	542	572	30
469	459	449	439	429	419	409	399	389	379	369	519	559	40
446	436	426	416	406	396	386	376	366	356	346	496	546	50
424	414	404	394	384	374	364	354	344	334	324	474	534	60
401	391	381	371	361	351	341	331	321	311	301	451	521	70
378	368	358	348	338	328	318	308	298	288	278	428	508	80
355	345	335	325	315	305	295	285	275	265	255	405	495	90
332	322	312	302	292	282	272	262	252	242	232	382	482	100
310	300	290	280	270	260	250	240	230	220	210	360	470	110
287	277	267	257	247	237	227	217	207	197	187	337	457	120
264	254	244	234	224	214	204	194	184	174	164	314	414	130
241	231	221	211	201	191	181	171	161	151	141	291	431	140
219	209	199	189	179	169	159	149	139	129	119	269	419	150
197	187	177	167	157	147	137	127	117	107	97	247	407	160

The rectangle 426-396 to 312-282 indicates the limits of optimum dietetic ranges and the polygon with zig-zag lines, that appropriate for diabetes, except the severe grades in which carbohydrates must be kept at or even below the theoretic minimum of 80 grams, below which fatty acid intoxication is liable to develop. In such cases, the table may be continued to the right, increasing the proteid by ten in a column and decreasing the carbohydrate correspondingly. Such an extension is not only theoretic but practical since, while nitrogenous elimination is unduly increased, proteid may be utilized with comparatively slight waste, up to a maximum of over 200 grams. On the other hand, if much more than 150 grams of fat is given, there is both physiologic waste of this substance and disturbance of digestion causing waste of other ingredients. The first three vertical columns at the left down to about 120 for fat, represent the opti-

mum diet according to Chittenden, although even he would scarcely claim that a man of average size would maintain nitrogen equilibrium on the 50 gram ration of proteid or invariably on the 60 gram ration.

Comparing the top and bottom lines, we get an idea of the possible increase in portability of food, by increasing the proportion of fat. While the top line probably represents a possible ration, the second or third lines represent a ration about as nearly fat-free as can be obtained from the use of ordinary food-stuffs.

It will be noted that every 100 calories correspond to about 25 grams of proteid or carbohydrate or both and to about 11 of fat. Similar tables could easily be constructed for any given number of calories, but, as for persons under medical observation, it rarely happens that we need to increase the calories by more than a very few hundreds or should be satisfied with a number similarly below the standard, unless we can safely increase or reduce any one food ingredient without regard to the reciprocal relations shown in the table, additional tables are scarcely needed.

CHAPTER III.

STANDARD DIET IN HEALTH.

Although the average healthy adult uses a great variety of food stuffs, combined in the kitchen in many different ways and differing widely in bulk and weight, and although he eats these in quantities differing widely at different meals, there is a general tendency to vicarious use of approximately similar food stuffs so that about the same average quantity of a similar group is taken in a day. So, too, while different individuals habitually make one or other meal light or heavy, there is a tendency towards equilibrium on any average day. Many food stuffs, also, such as cheese and relishes are taken in negligible quantities, and many others, such as the bulky vegetables, contain comparatively small proportions of nutriment and so imbedded in cellulose that little is assimilated. For these reasons, the standard diet may be outlined in comparatively simple form.

Breakfast	Cereals inc. bread, etc.	Sugar inc. syrup	Butter	Cream	Milk	Potato and sweet potato	Legumes as fresh	Eggs	Fruit	Lean meat
5	1	1	...	½	½	...	...	1	1	...
Luncheon. 7½	1	1	1	½	..	1	1	....	1	1
Dinner....	2	1	1	½	½	1	1	..	1	1
	Add for olives, innutritious vegetables, etc, 1.									
	Add for dessert, aside from fruit, 3.									
13	Add for soup ½, for cheese, ½.									
Extra.										
3	Add for nuts, candy, etc., taken between meals, 3.									

The units are the 100 calories according to Prof. Irving Fisher's table. The total consumption of calories is, then, about

2850, a full allowance for a business or professional man. The proteid content of such a dietary is 60—75 grams. The cream and sugar taken as such are largely used for beverages. The milk used at breakfast is allowed for the cereal; that at dinner for cooking vegetables, soup, etc.

Obviously, if one eats two shredded wheat biscuits or two ordinary servings of cereal at breakfast, or uses both cereal in the limited sense and bread or toast, or if one follows the standard breakfast with meat and potato, the breakfast equals or even exceeds the standard luncheon. So, too, the luncheon may be magnified into a dinner and the dinner into a banquet, and the equivalent of a breakfast or luncheon may be added late in the evening. Thus, without conspicuous gluttony, the daily intake may be as follows:

Breakfast...	7
Luncheon...	13
Dinner... ..	20
Supper.....	7
Extras....	3
	—
	50 100-calorie units, or 5000 calories.

But any such intake is attended with a very decided compensatory digestive failure, even a moderate delay in digestion allowing the destruction by bacteria of considerable quantities of proteid and still greater quantities of carbohydrate and fat, and to direct elimination of practically unchanged fat through the bowel, beyond the usual loss which is not considered in the standard table. Thus, if on a dietary sufficient in other respects much over 100 grams of fat is ingested, there is a direct loss of 20 or 30 grams of fat corresponding to about 2 100-calorie units. Counting all sources of loss, the ingestion of food representing 5000 calories probably does not involve the assimilation and metabolism of more than 4000 calories, perhaps much less.

Owing to the vast number of individual food stuffs, their varying percentages of proteid, fat and carbohydrate, the relative lack of natural food stuffs containing only one of these dietetic

elements, the lack of availability of artificial food stuffs for continued use, and the absolute lack of any single natural food stuff which may be considered as in any practical sense a complete aliment—even in the limited sense of organic foods—it is impossible to make out a dietary by algebra.

Generally speaking, for persons in health and those not acutely sick, the most practical plan is to have prepared a table stating that the patient has actually eaten such and such food stuffs, in given amounts, for each of the three meals. If considerable accuracy is required, the food stuffs should be weighed and foods which are elaborately blended in the kitchen should be avoided, unless the proportion of each single food stuff in the blended preparation is accurately known from the recipe followed. If only approximate results are desired, Fisher's table of "portions" may be followed, with due precautions as to certain ingredients which are obviously not easily measured by guess.

A balance is better than a spring scale and new five-cent pieces may be used as 5-gram weights. A cheap and quite delicate balance may be improvised from a metal rod, shallow aluminum cups, tin can covers, etc., suspended by silk threads or fine wires. Small smooth holes should be drilled through the rod, at the middle and two points equidistant from the respective ends. Such a balance should be tested empty and can be adjusted by filing away the ends of the rod or by placing weights in the lighter pan. With a little care it should easily be made to weigh within an error of half a gram.

Knowing from the table that the patient is taking so many grams of meat, bread, butter, potato, etc., in the day (translating from amounts stated in ounces, if necessary), recourse is had to analytic food tables to determine the amount of proteid, fat, carbohydrate in each ingredient, for the day. The number of calories may be added in a fourth column if desired. The labor is much simplified by asking the patient to confine himself to articles listed in the analytic tables.

If the diet actually taken contains 50—100 grams of proteid, 10—100 grams of fat and 250—400 grams of carbohydrate, and the total calories are about 2500, the diet may be considered satis-

factory, unless, for any reason, it is desired to decrease or increase any ingredient or to exceed or reduce the standard amount of nutriment; and unless, also, any particular food stuff is indigestible, liable to cause alimentary saprophytosis or otherwise undesirable.

If the proteid intake is correct but the total number of calories high, a diminution must be made in butter, oils, sugar, syrup, corn starch, etc. If, as may happen, none of these nearly pure non-proteid food stuffs are used in excess, and the proteid is not too high or even rather low, bread stuffs, cereals and vegetables must be reduced and more meats or whites of eggs must be taken to make good the ration of proteid.

If the proteid is high, meats, etc., must be diminished, and if it is necessary to increase the calories, the non-proteid fatty and carbohydrate food stuffs may be increased. Other modifications will suggest themselves from an inspection of the diet sheet, after calculating the proteid, fat and carbohydrate in grams and the calories. Appropriate sample dietaries are given in Chapter XVIII. All of these have been elaborated on the "cut and try" plan.

For example, the following diet list is furnished by the patient:

Breakfast: 1 shredded wheat biscuit.
1 banana.
1 orange.
2 eggs.
2 lumps of sugar.
150 c.c. of cream used on biscuit and in coffee.

Luncheon: 2 lamb chops.
1 small boiled potato (50 grams).
2 slices of bread (50 grams).
2 servings of butter (30 grams).
2 lumps of sugar.
200 c.c. of milk in cocoa (cocoa not counted).
100 c.c. fruit sauce (counted as 20% sugar, proteid and fat negligible).

Dinner: Bouillon (practically no nourishment).
5 small crackers (5.5 grams each, on average).
100 grams roast beef.
1 large potato (100 grams).
100 c.c. stewed peas.
100 c.c. ice cream.
1 piece sponge cake (50 grams).
4 lumps of sugar and 100 c.c. cream in two cups of coffee.

This diet sheet is summed up by the physician as follows:

	Amount Grams.	Proteid %	Proteid Grams.	Fat %	Fat Grams.	Carbohydrate %	Carbohydrate Grams.
Shredded wheat biscuit..	30.	10%	3.G.	2%	0.6G.	75%	22G.
1 banana net weight....	45.		5.	....			20.
1 orange net weight.....	150.	2%	3.	....		10%	15.
2 eggs	......		17.		10.	....	
Sugar in beverages, 8 lumps..............	48.	....		....		98%	47.
Cream................	250. c.c.	3.5%	9.	25%	62.	3.5%	9.
Lamb chops, net weight..	40.	15%	6.	30%	12.	....	
Potato................	150.	2%	3.	....		20%	30.
Bread.................	50.	8%	4.	1.5%	2.	50%	25.
Butter................	30.	....		90%	27.	....	
Milk..................	200 c.c.	4%	8.	4%	8.	4%	8.
Fruit sauce...........	100 c.c.	....		....		20%	20.
Crackers..............	27.5	10%	3.	9%	3.	70%	20.
Roast Beef............	100.	20%	20.	1%	1.	....	
Stewed peas...........	100 c.c.	5%	5.	4%	4.	10%	10.
Ice cream.............	100 c.c.	4%	4.	13%	13.	33%	33.
Sponge Cake...........	50.	6%	3.	11%	5.	65%	32.
Total Grams.........			93.		148.		291.
Calories...............			455.7		1386.4		1193.1
Total calories, 3035.2.							

It is obvious that the above patient is over-eating to the extent of about 500—700 calories, that he is eating more proteid than is necessary, though not an excessive amount, that he is eating 1¼ to twice as much fat as he should, and, counting as sugar, the carbohydrate from the orange, the lump sugar, the fruit

(Note that in making the above estimates, fractions are commonly disregarded.)

sauce, estimating the sugar as $\frac{7}{8}$ of the carbohydrate in ice cream, and allowing that 20% of the sponge cake is sugar (10 grams), we find that he is eating about 130 grams of sugar a day. Perhaps it would be better to use more starch and less sugar, still most well-to-do persons eat about this quantity of sugar a day, and it is probably harmless unless there is a tendency to glycosuria or diabetes or to fermentation in the alimentary canal. It is easy to see that the excess of fat and of calories—though with so large an ingestion of fat, 10 or 20% of it, or approximately 135—270 calories, are probably wasted in the faeces—is very largely due to the cream. By merely substituting milk for cream, we would reduce the fat by about 52 grams, increasing the proteid and carbohydrate about 1 gram each, and reducing the total calories by over 450, or to very nearly the standard.

However, the use of milk to the amount of 450 c.c. (about a pint) a day, by an ambulant patient, in addition to an ordinary dry diet, is excessive. It would be better to reduce the milk in the cocoa by using half water, to use one cup of coffee at dinner, and to allow a reasonable amount of cream. Then, too, a person at light exercise does not need eggs or meat in addition to the cereal-fruit breakfast, nor does he need two chops for luncheon. Thus, in various ways, the diet may be reduced, especially in regard to fat and somewhat for proteid.

Actual Consumption of Food by Ambulant Patient for One Week.

List as furnished by patient, weighing, as a matter of convenience, in pounds (453.6 grams), ounces (28.35 grams) and nickel 5-cent pieces (5 grams), and calculated from tables:

	GRAMS.	PROTEID.	FAT.	CARB.
Potatoes 6 lbs., 26 nickels	2851	37	3	513
Meat 1 lb., 3 oz., 3 nickels	553	100	28	..
Crackers 1 lb.	454	45	27	319
Toast 12.5 oz.	354	41	6	216
Butter 1 lb., 9 oz.	709	7	603	....

		GRAMS.	PROTEID	FAT.	CARB.
Eggs 13		550	110	65	....
Cookies 1 lb		454	32	45	328
Apple sauce 6 oz., 5 nickels		189	..	1	70
Apple pie 10 oz., 6 nickels		313	9	31	135
Berries, 17 nickels		85	1	1	7
Cucumbers, 25 nickels		125	1	....	3
Corn 5 oz., 1 nickel		147	4	1	28
Cheese 6 oz., 6 nickels		200	50	66	....
Rice pudding 4 oz., 3 nickels		128	4	...	31
Biscuits, 60 nickels		300	27	30	165
		7512			
Milk 11 pints	5204 c.c.		208	208	208
Water 4 pints	1792				
Tea 8 pints	3585				
Coffee 1 pint	473				
Cocoa ¼ pint (est. as 15 G. cocoa powder, milk already counted)	237	...	3	4	7
Root beer 1 pint	473			...	25
Totals for week	7)11746		7)679	1119	2055
Avg. totals for one day	1680		97	159	294
Calories (total, 3159)			475	1479	1205

This patient had been treated for the uric acid diathesis, although there was no excess of uric acid and not even a deposit of urates in the urine to suggest such a diagnosis. The diet, which is stated by the patient to be a fair average, is obviously not high in purins. The urine contained an average, on two examinations, of 26 grams of urea, corresponding to about 12.5 grams of nitrogen. The proteid eaten contained about 15 grams, or, at most, 16 grams in the diet including the caffeine, etc., of tea and cocoa. Adding 1/7 of the urinary nitrogen to account

for the faecal catabolic nitrogen, we have about 14.3 grams of nitrogen accounted for, representing a waste of almost exactly 1/10 of the total, which is to be expected.

On inspecting the diet sheet, it is apparent that the patient takes too little water, both as such and in the aggregate. He is taking rather too much tea and coffee, and, considering the totals of nutrients, too much milk. It would be well to reduce his tea and coffee to a total of 4 or 5 pints a week, the milk to 7 or 8 pints (say 500 c.c. a day), and to increase the water so as to make a total ingestion of liquids of at least 14,000 c.c. a week.

The above mentioned reduction of milk reduces the corresponding nutrients to 140 each instead of 208 each, for the week. This alone, reduces the daily average of proteid to about 87 grams, which is high according to Chittenden, but not according to most authorities, the patient being a good sized man, engaged in professional work, and weighing about 80 kilograms. The reduction of milk also reduces the total daily calories by about 180, or to about 2980. The use of butter is plainly excessive and should be at least divided by two. In this way, the total daily consumption of fat can be reduced to about 115 grams and the calories to about 2440. Most persons would do well to eat about 50 grams of sugar a day, which would raise the calories to 2645. We might also eliminate the cheese, though its moderate use is not harmful, or reduce the eggs. In this way the proteids and total calories could be still further reduced so as to approach the minimum active standard. However, there is, in the present case, no indication to do so at the cost of an unsatisfied appetite.

CHAPTER IV.

QUANTITATIVE ESTIMATION OF DIET.

As commonly practiced, dietetics is mainly qualitative and based on empiricism. While it is measurably true that a normal appetite is a safe guide to the kind and quantity of food to be eaten, and while it is often easy to say that one person eats too much, another too little, either in general or with regard to one particular kind of food, it is self-evident that dietetics can never take its place on the same scientific basis as chemic diagnosis and drug therapy, without due attention to quantitative estimates.

Just as delicate balances and means of measuring small volumes are more necessary for scientific research than for pharmacy, so the comparatively large units employed in dietetics render dietetic quantitations less delicate than those employed in prescribing and dispensing the proper doses of medicines. And, as it is allowable in practice to dose out certain bulky drugs by the eye, so it is both allowable and feasible to form a visual memory of the size of a viand corresponding to a given weight or round number of calories.

The practitioner who would be a scientific or even a practical dietetician, can not ignore quantitative methods. Comparing the relative values of food administration and drug administration, quantitation of the former is easier and simpler in all respects. Partly on account of our relative ignorance of physiologic chemic processes and the organic chemistry of plant and animal tissues, but largely on account of the greater simplicity of dietetics as compared with drug therapy, we have, instead of a vast number of active principles and definite chemicals, comparatively few and, of these few, quantitative methods are applicable only to proteid, fat, carbohydrate, including a few simple subdivisions of each, salt, water and a

few substances, such as salt, water, alcohol and certain spices, whose quantitative consideration is already included under materia medica and therapeutics of drugs.

In dietetics we deal largely with crude plant and animal substances of considerable variety, yet much more susceptible than the materia medica of being classified into groups of approximately the same percentage strength of the physiologically valuable ingredients. Cooking, though quite an elaborate art, closely comparable to that of the pharmacist, is familiar so far as its general principles and terms are concerned, and presents no difficulties in the way of modified dosage, excepting that elaborate combinations of food can be quantitated only by reference to the analysis of the ingredients or by special analysis.

While scientific metabolism experiments require the extemporaneous analysis of the foods used and very exact weighing, the practice of dietetics can almost always be conducted by reference to analytic tables and the doses of food stuffs are so large and subject to so much variation within physiologic limits, that only approximately accurate weighing is required and even measurement of liquids and enumeration of food stuffs of fairly constant average weight, such as crackers, rolls, lumps of sugar, eggs, etc., will suffice. Moreover, the arithmetic calculations, though somewhat tedious, are within the ability of a child of twelve years, and need not be carried out into lengthy fractions.

The physician would do well to memorize the approximate composition in proteid, fat and carbohydrate of a few commonly used foodstuffs, for example, lean meats, fat meats, milk, cream, eggs, breadstuffs, cereals, legumes, potatoes, etc., and to recognize the rank in food values of the common vegetables and fruits. He should also memorize the standard ration expressed both in terms of proteid, fat and carbohydrate, and in calories, and the calorific values of these nutrients per gram. It is also well to memorize a few of the 100-calorie units as worked out by Irving Fisher. All told, the actual memorizing of numbers does not amount to a tenth part of that required of the student in materia medica as a minimum for actual practice.

In addition, just as the practitioner who dispenses his own

medicines, weighs and inspects standard doses of bromid, bismuth and other drugs of large dosage, so that he can dispense them with sufficient accuracy by the eye, he should learn—most satisfactorily by actual weighing—the size of a cut of meat, slice of bread, serving of potato, etc., corresponding to a definite number of grams. For example, the lean meat of a lamb chop weighs 15—25 grams, an ordinary slice of roast meat weighs 50 grams, a single potato about 50—100 grams. This facility in estimating food values by the eye can very easily be obtained under ordinary domestic circumstances, and is of great value, not only in enabling the physician to prescribe the diet of his patients, but as a matter of personal hygiene.

The study of economic dietetics is also a matter of considerable importance. It is an easy and interesting matter to compare prices with caloric values, or with content in proteid or other constituent particularly needed in any given case. Knowledge of this sort gives the physician a practical utility in the management of institutions and even in the community, by virtue of his influence as a popular educator.

A physician who was ignorant of the chief ingredients of opium and of its approximate richness in morphine, would be considered culpably ignorant, yet physicians of repute feed typhoid patients on ridiculously inadequate quantities of milk, imagine that they are maintaining nutrition by spoonful doses of meat extracts, by small and infrequent enemata or by badly balanced dietaries of various kinds; and surgeons pour into fistulae, established at great risk to the patient, nutrients entirely unfitted to fulfill the purpose for which the operation was undertaken. If quantitative data were unknown or inaccessible, such therapeutic failures might be excused, but, as has been explained, the acquisition of a knowledge of dietetic dosage and composition is far simpler than for drugs.

Mechanical Estimation of Diet by Typewriter.

The scale bar of a typewriter may be utilized to estimate the amounts of proteid, fat and carbohydrates in food stuffs, with considerable accuracy, although arithmetic calculation cannot be

entirely avoided, and all instrumental methods of calculation, unless long numbers are involved, are rather fallacious as savers of time and insurance against errors.

Starting with the patient's or nurse's diet list, in which the amounts of different food stuffs are stated for each meal, the indicator is set at zero on the scale bar and the number of grams or c.c. of each food stuff is indicated by printing the name of the food stuff with the initial at zero, and then at a point corresponding to the number of grams. The ordinary typewriter allows a measurement of about 75 on one line. If large numbers are involved, it is more convenient to measure them off by fifties. Capital letters are usually more accurately measured than small letters because the former have more definite vertical lines. Or, if preferred, periods may be used to mark the beginning and end of the line and the name of the food stuff may be printed anywhere along it, as most convenient.

For example, suppose that the patient takes 30 grams of bread as toast, at breakfast, 50 at luncheon and 85 at dinner, this may be indicated as follows:

```
Bread                         Bread
Bread                                             Bread
Bread                                             Bread
Bread                              Bread
                              or:
.                             .
.                                                 .  Bread
.                                                 .
.                                  .
```

The totals are mechanically added by a pair of dividers, swinging them back and forth in passing from one line to another and spreading from the fixed leg, as usual in such operations. Of course where such simple numbers are involved, the mechanic method is unnecessary and is more troublesome than simple arithmetic. The totals are marked off on a ruler, divided accord- to the scale bar which usually represents 1–10 of an inch for each letter space. Obviously, measurements should always be made

from and to the same part of the initial letter, unless periods are preferred. Generally speaking, this first step in the mechanic calculation should be omitted altogether, the patient or nurse stating on the diet sheet the number of grams of each food stuff used for the entire day.

Having the daily totals for each food stuff and an analytic table before the eye, the estimation of proteids, fats and carbohydrates is made as follows, the sample diet being simple, fairly cheap, and sufficient for a person at light exercise.

Crackers, 6×25 grams, 150 grams, 10% proteid, 9% fat, 70% carbohydrate

P P
F F
C C
C C

Bread, 378 grams, 8% proteid, 1.5% fat, 50% carbohydrate.

P P
F F
C C
C C
C C
C C

Meat, 225 grams, 20% proteid, 2% fat.

P P
F F

Oysters, 225 grams, 5% proteid.

P P

Cocoa powder, 13% proteid, 48% fat, 30% carbohydrate. 30 grams

P P
F F
C C

Milk, 150 c.c., 3.5% proteid, 4% fat, 4% carbohydrate.

P P
F F
C C

Sugar, 60 grams, 98% pure carbohydrate.

C C

Butter, 28 grams, 90% pure fat.

F F

NOTE. Owing to the difference in size of type and length of line, it is impossible to reproduce the typewriter estimation exactly.

It should be noted that the computations can almost always be done mentally, as analyses of different food stuffs of the same kind vary considerably, so that to attempt very accurate calculations with two or three decimal places would be straining at a gnat after swallowing a camel. Excepting bread stuffs and other cereals, which have both a high percentage of one nutrient and are used in considerable quantities, it is rarely that the day's ration of any one of food stuffs exceeds the capacity of one line of the scale bar. Indeed, on the Chittenden diet, the entire proteid ration would not exceed this capacity, nor should the total fat go much beyond the limit of the scale bar. Excepting for bread stuffs and sugar when used freely. no one food stuff is likely to exceed the limit for representing carbodydrates. When, however, two or more lines are required, it simplifies the addition to stop at 50 on the bar. It will be noted that the vertical lines of the P and F and the convexity of the terminations of the C furnish convenient measuring points. While it is scarcely necessary to regard fractions, the carriage may be held by hand at an intermediate point between the divisions. As for all scientific work, a visible writing machine is preferable in many ways, but any ordinary typewriter can be used.

Measuring with the dividers, which will stretch to indicate the fat and the proteid ration and which will require not over four or five measurements for even a large carbodydrate ration,

we find, in the present instance, the proteid measurement to be 11 inches (110 grams), the fat 6.9 (69 grams), the carbohydrate 27.1 plus (271 grams).

Graphic Method of Calculating Calories on the Principle of Proportionate Triangles.

Since one gram of fat, proteid and carbohydrate, respectively, yields 9.3, 4.9 and 4.1 calories, triangles having a common angle and base line, with bases of 1, 4.1, 4.9 and 9.3 units will have proportionate lengths on corresponding parallel sides, so that, if this side is marked off in units for the smallest triangle and read as grams, corresponding sides of the larger triangles will measure, in corresponding units, calories yielded by the respective kinds of nutrients. It is not necessary that the triangles should be right angled, although this is the most convenient construction, nor that the units for the base line should be the same as for the parallel sides. Solely on account of the difficulty of measuring small distances, it is better to multiply the dimensions of the unit triangle by ten, so that the distances from the common angle will be 4.1 for carbohydrates, 4.9 for proteids, 9.3 for fats and 10 for the triangle used to measure grams. On account of this construction, each unit read as grams will correspond to ten units read as calories. Obviously, the larger the triangles, the more accurate the reading, and the larger quantities of organic foods can be estimated at one reading. On the other hand, it is inconvenient to deal with too large charts.

Half-inch or two-centimeter units are convenient for measuring the base line, and quarter-inch or centimeter units for each ten gram or 100 calories on the parallel sides will enable one to read off a moderate day's ration of any organic food constituent at once, and with a fair degree of accuracy, on a chart not too large for convenient handling.

Estimation of Diet by 100-Calorie Portions.

Professor Irving Fisher of Yale University has elaborated a very ingenious mechanical method of estimating diet by an ap-

paratus which automatically finds the center of gravity of small weights representing units of 100 calories each. Unfortunately, this method requires that the analysis of all dishes shall be made with a fair degree of accuracy and that each serving shall be weighed out in the kitchen, also that the patient shall eat the whole or a definite fraction or multiple of any serving, or that waste shall be accurately weighed. Thus, the method is applicable only to institutions, and even then must be considered as merely approximate.

However, Fisher's table of 100-calorie units is a very convenient basis of a general conception of a standard diet, either in health or disease, and the computations may be made arithmetically, instead of by the gravity-instrument. In using the appended table, it must be remembered that the proteid, fat and carbohydrate percentages of the 100-calorie units, represent calories produced from each of these organic ingredients, without allowance for either ingestive or digestive waste, and that the units vary in actual weight. Thus, if it is desired to know the number of grams of proteid in a unit, we must first divide the proteid-calorie percentage by 4.9 (the number of calories produced by the oxidation of a gram of proteid) and must then multiply the actual weight of the 100-calorie unit by this new percentage. Similarly, the fat-calorie percentages must be divided by 9.3 and the carbohydrate-calorie percentages by 4.1.

It is obvious that the average adult requires, according to the amount of exercise, exposure to cold, etc., somewhere between 22 and 30 of these 100-calorie units in a day, and that, to insure that the proteid does not fall below 50 grams nor exceed 100 grams, the total of proteid calories should lie between about 250 and 500. Also, it is obvious from the general principles already discussed, that the fat calories should preferably be less than 1000, and that, to avoid fatty- acid intoxication, the carbohydrate calories should amount to 325. Ordinarily, they should lie between 1200 and 2000, the latter being a rather large allowance.

An ideal standard diet would consist of 250 proteid calories, 500 fat calories and 1500 carbohydrate calories, for a professional

or business man, taking very little exercise. The same man, taking considerable exercise, would require up to 300 proteid calories, and a total of about 2500 calories, which could be dis-

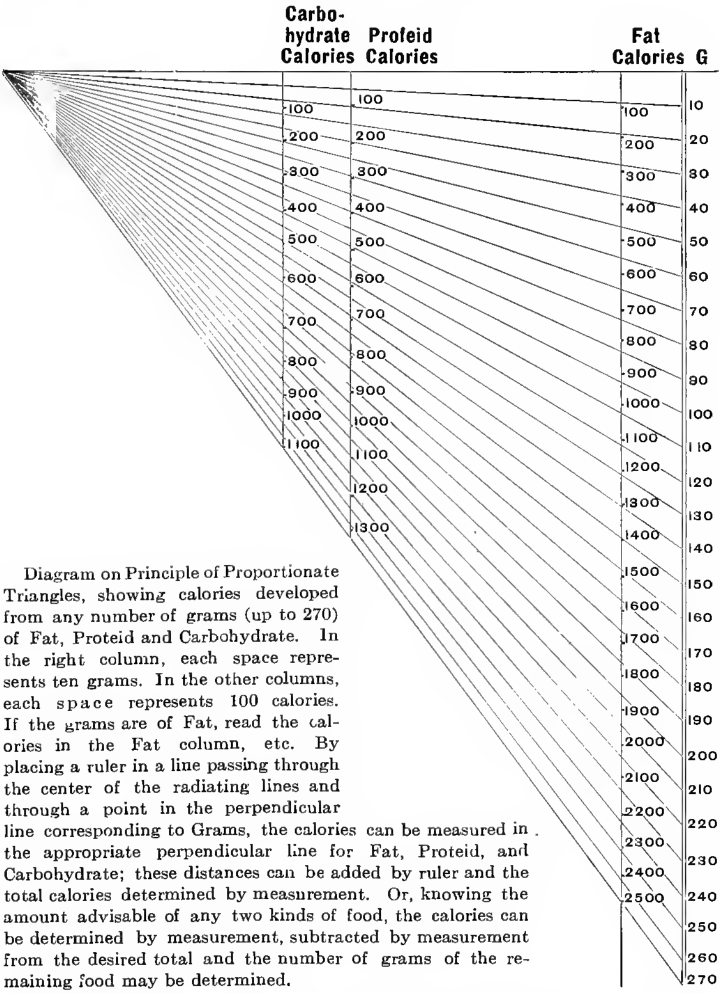


Diagram on Principle of Proportionate Triangles, showing calories developed from any number of grams (up to 270) of Fat, Proteid and Carbohydrate. In the right column, each space represents ten grams. In the other columns, each space represents 100 calories. If the grams are of Fat, read the calories in the Fat column, etc. By placing a ruler in a line passing through the center of the radiating lines and through a point in the perpendicular line corresponding to Grams, the calories can be measured in the appropriate perpendicular line for Fat, Proteid, and Carbohydrate; these distances can be added by ruler and the total calories determined by measurement. Or, knowing the amount advisable of any two kinds of food, the calories can be determined by measurement, subtracted by measurement from the desired total and the number of grams of the remaining food may be determined.

tributed without danger in any way, providing that the limits mentioned in the last paragraph are not exceeded in any case.

The following diet table would be considered, by most men, as rather abstemious, and yet it is ample for one not performing manual labor.

BREAKFAST— Viand	loo-calorie portions	proteid calories	fat calories	carbo-hydrate calories
Shredded wheat (1).	1	13.	4.5	82.5
Milk, 140 c.c., on biscuit and in coffee.	1	19.	52.	29.
Sugar in coffee, 3 lumps.......	2			200.
Orange, half.	0.5	3.	1.5	45.5
	4.5	35.	58.	357.0
LUNCHEON—				
2 lamb chops......	2	48.	152.	
1 good-sized potato.....	1	11.	1.	88.
2 slices bread....	2	26.	12.	162.
1 small butter ball.	1	.5	99.5	
Sugar in coffee, 1½ lumps.. ..	1			100.
Milk, 35 c.c.....	.25	4.7	13.	7.2
Peach sauce, 1 dish....	1	4.	2.	94.
	8.25	94.2	279.5	451.2
DINNER—				
Small serving roast beef........	1	25.	75.	
1 potato...	1	11.	1.	88.
String beans, 1 dish. ...	.2	3.	10.	7
Carrots, 1 dish....	.5	5.	17.	28.
Fish, small serving.	.5	40.	10.	
Clam chowder, 1 plate... ...	.5	8.5	9.	32.5
3 lumps sugar.	2.			200.
Milk, 70 c.c...	.5	9.5	26.	14.5
Butter, 1 small ball.	1	.5	99.5	
4 graham crackers..	2	18.	40.	142.
Mince pie, ordinary piece.......	4	32.	152.	216.
	13.2	152.5	439.5	728.
Daily total calories......	.2595	281.7	777	1536.2

(Note that the sum of the proteid, fat and carbohydrate calories agrees within .1, the slight error being due to the fact that divisions of portions were carried out only one decimal place.)

A hearty eater, still far removed from what is ordinarily considered gluttony, would add to the above dietary, for breakfast, 2 large or 3 small eggs (2 100-calorie portions), another cereal serving of some sort (1 portion), a banana (1 portion), and, through the day, 3 butter balls (3 portions), an additional serving of meat (1 portion), an additional serving of some vegetable (1 portion), 1.5 cubic inches of cheese (1 portion), 3 or 4 olives (1 portion), 8 almonds (1 portion), 3 Brazil nuts (1 portion), 8 pecans (1 portion), a piece of cake or doughnut (2 portions), and extra serving of dessert (1—4 portions), and say an eighth of a pound of candy (2 portions). Here we have an addition of 19—23 portions, or very nearly the total calories required altogether.

Many persons eat 30—60 grams of butter at a meal, i. e., approximately $\frac{1}{3}$—$\frac{2}{3}$ the entire daily ration of calories. The caloric value is particularly high for fruits, desserts, etc., which most persons fail to regard as food at all. An apple represents 50 calories ($\frac{1}{2}$ portion) and most servings of fruit sauces represent at least one portion. Every doughnut or piece of cake represents 2 portions, and an ordinary piece of pie 2—4 portions. Thus, half of the entire caloric ration may be taken at the dessert of one meal. Many good feeders, so called, habitually eat more than double the requisite ration.

CHAPTER V.

APPROXIMATE METHOD OF CHECKING THE DIET BY WEIGHT AND THE EXCRETIONS.

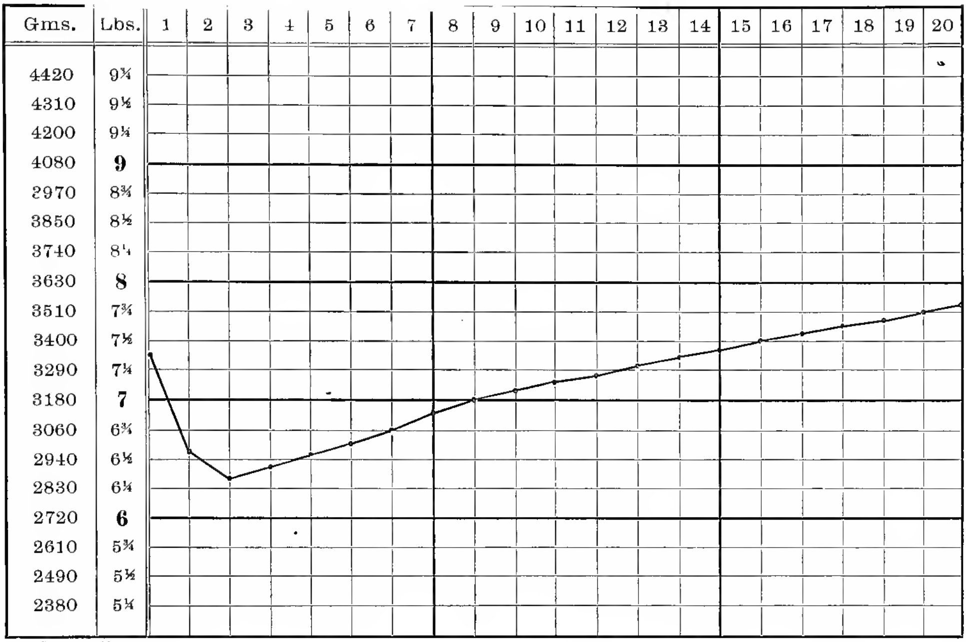
While very exact methods of quantitating and analyzing the intake of food and output of excrement and excretions are required for physiologic purposes in the study of metabolism, these methods are obviously impracticable for the physician. However, certain approximate and quite simple methods along the general line are practical and useful.

Probably the very simplest and most useful item is a knowledge of the weight from time to time. It should not be forgotten that differences of many pounds may be due to changes in clothing and in the contents of the pockets, that a single discharge of urine, a single drink of water, or one meal, may amount to a pound or more and that fluctuations in perspiration, accumulations in the alimentary canal, etc., may also cause marked diurnal variations. Hence significance can be attached only to rather regular and progressive changes for considerable periods. While, as is explained elsewhere, oxidation can scarcely cause a net loss of weight of more than 300 grams in a day—though larger amounts may be lost by discharge or evaporation of water, and of sugar in diabetes—it frequently happens that a pound or more of fat or of fat with proteid and glycogen, may be stored by the normal body under an excessive diet.

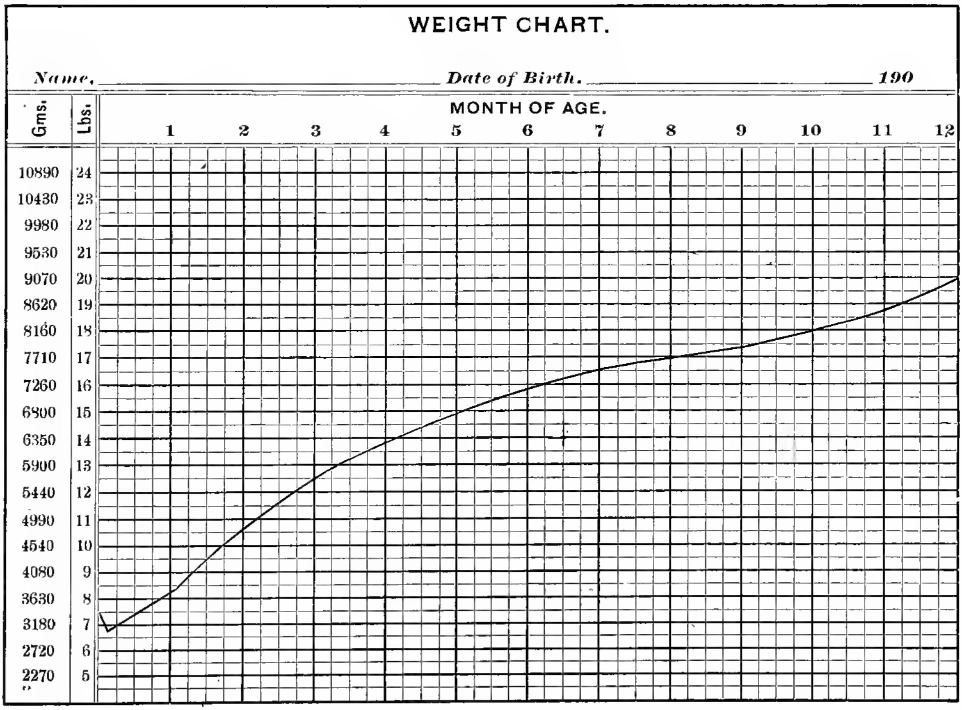
In using the table of heights and weights, it should be remembered that the age, during adult life, should not be considered to any extent in estimating the proper weight for a given height, although there is tendency, not entirely due to unhygienic factors, such as lack of exercise and overeating, toward gradual deposit of fat up to about the 50th year, and a gradual decline of appetite and of fat in old age. A variation of ten or possibly 20 per cent. either way from the standard should not be considered pathologic

FROM BIRTH.

Name.... ....190......

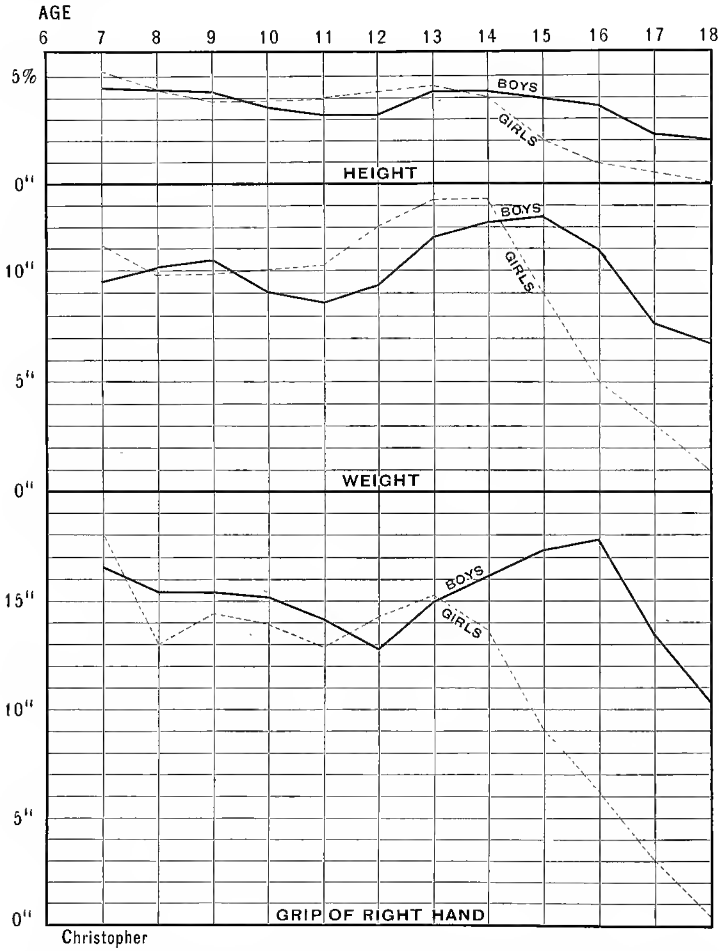


L. Emmet Holt



L. Emmet Holt

although, on the whole, it is better for persons not liable to irregularities of exposure, exercise and meals, to keep at or slightly under the standard.



As commonly taken, the weight is adventitiously increased to a considerable extent. A man will ordinarily carry 1—2 pounds extra weight in his pockets, not including articles temporarily

carried. The lightest summer clothes for a man who dresses well, not referring to outing suits for particular purposes, weigh 7—8 pounds, without vest and with the lightest underwear. This adventitious weight may be more than doubled in winter, not

TABLE OF AVERAGE HEIGHT AND WEIGHT—DR. HEINRICH STERN.

AGE.	MEN.				WOMEN.			
	Height, inches.	Height, cm.	Weight, pounds.	Weight, kilo.	Height, inches.	Height, cm.	Weight, pounds	Weight, kilo.
1 ..	28.74	73	21.78	9.9	28.50	72.4	20.24	9.2
2 ..	32.67	83	28.16	12.8	32.44	82.4	24.60	11.2
3 ..	35.82	91	32.70	14.9	35.59	90.4	29.04	13.2
4 ..	38.18	97	36.68	16.9	37.95	96.4	33.	15.
5 ..	40.55	103	39.60	18.0	40.31	102.4	35.20	16.
6 ..	42.91	109	43.34	19.7	42.68	108.4	38.50	17.5
7 ..	45.27	115	47.08	21.4	45.04	114.4	41.58	18.9
8 ..	47.63	121	51.7	23.5	47.40	120.4	40.92	18.6
9 ..	50.	127	55.60	25.3	49.76	126.4	49.06	22.3
10 ..	52.36	133	60.94	27.7	52.13	132.4	54.56	24.8
11 ..	54.33	138	66.40	30.2	54.09	137.4	58.52	26.6
12 ..	56.30	143	72.60	33.	56.06	142.4	67.98	30.9
13 ..	58.27	148	78.10	35.5	58.03	147.4	77.44	35.2
14 ..	59.84	152	84.40	38.4	59.60	151.4	87.34	39.7
15 ..	61.42	156	105.80	48.1	59.84	152.0	97.02	44.1
16 ..	63.39	161	120.10	54.6	60.	152.4	97.46	44.3
17 ..	65.35	166	132.80	60.4	60.39	153.4	......	....
18 ..	66.93	170	136.40	62.	61.18	155.4	......	....
19 ..	67.32	171	138.60	63.	61.84	157.	118.80	54.
20 ..	67.72	172.	144.10	65.5	62.36	158.4	122.10	55.5
25 ..	68.90	175	151.80	69.	63.15	160.4	124.30	56.5
30 ..	69.29	176	154.	70.	63.78	162.	124.30	56.5
35 ..	68.90	175	157.30	71.5	63.54	161.4	127.60	58.
40 ..	68.90	175	166.60	73.	63.39	161.	133.10	60.5
45 ..	68.11	173	161.70	73.5	62.99	160.	132.	60.
50 ..	67.72	172	156.20	71.	61.81	157.	128.70	58.5
55 ..	67.32	171	151.80	69.	61.42	156.	126.50	57.5
60 ..	66.93	170	149.60	68.	61.02	155.	126.50	57.5
70 ..	66.14	168	145.20	66.	60.23	153.	117.70	53.5

including hat, overcoat, rubbers, etc. Women's clothes vary much more in weight, and not so uniformly with the seasons, the ordinary limits being 5 and 20 pounds. Thus, if the naked weight cannot be secured, accurate estimates of weight require

the tare of the clothing, and even increase and decrease, to be significant, must be reckoned from weighings with identical garments.

Under ordinary circumstances the body loses about 1000 c.c. of water a day by the skin and kidneys each, 550 by the lungs, and 50—200 c.c. by the faeces. Thus, generally speaking, water should be administered so as to maintain the urine at about 1000 c.c. daily, aggregating about 3000 c.c.

WEIGHT BY YEARS.

L. EMMET HOLT. CHILDREN.

BOYS.				AGE.	GIRLS.			
Height.		Weight.			Height.		Weight.	
Centimetres.	Inches.	Kilogrammes.	Pounds.		Centimetres.	Inches.	Kilogrammes.	Pounds.
49.37	19.75	3.25	7.15	Birth.	48.12	19.25	3.15	6.93
61.87	24.75	6.50	14.30	5 months.	59.12	23.25	6.30	13.86
73.82	29.53	9.54	20.98	1 year.	74.17	29.67	9.00	19.80
84.55	33.82	13.80	30.36	2 years.	82.35	32.94	13.31	29.28
92.65	37.06	15.90	34.98	3 years.	90.77	36.31	15.07	33.15
98.27	39.31	17.27	37.99	4 years.	97.00	38.80	16.53	36.36
103.92	41.57	18.64	41.00	5 years.	103.22	41.29	17.99	39.57
109.37	43.75	20.49	45.07	6 years.	108.37	43.35	19.63	43.18
114.35	45.74	22.26	48.97	7 years.	113.80	45.52	21.50	47.30
119.40	47.76	24.46	53.81	8 years.	118.95	47.58	23.44	51.56
124.22	49.69	26.87	59.00	9 years.	123.42	49.37	25.91	57.00
129.20	51.68	29.62	65.16	10 years.	128.35	51.34	28.29	62.23
133.32	53.33	31.84	70.04	11 years.	133.55	53.42	31.23	68.70
137.77	55.11	34 89	76.75	12 years.	139.70	55.88	35.53	78.16
143.02	57.21	38.49	84.67	13 years.	145.40	58.16	40.21	88.46
149.70	59.88	42.95	94.49	14 years.	149.85	59.94	44.65	98.23

Even in metabolism experiments, the skin loss in water, fat and nitrogen-containing epithelium—the nitrogenous matter in sweat being a mere trace except in renal or analogous visceral disease—is usually ignored. It is probable that a skin with active sebaceous glands, frequently bathed with warm water and soap, causes the loss of an appreciable amount of fat. Just how much is difficult even to estimate, but it is a significant fact that many

skins are as greasy as those into which 15—25 grams of fat has been recently introduced by inunction and the latter method is practiced only over a small area of the skin.

Heat Supply and Loss.

It is obvious that heat can be supplied to the body by external application, including the entry of hot air into the lungs, by ingesta, and by chemic change—practically entirely oxidation—within the body. As, even when the outer air exceeds the normal temperature of the body, the temperature is reduced to normal by evaporation of sweat, the external supply of heat can act only locally or in a negative way by diminishing the amount of radiation that would otherwise take place. As the ingesta can not be administered at a temperature of much over 50 degrees centigrade (122 F.), i. e., 13 degrees above the normal body temperature, and as they amount to 4 liters at most, and consist of water to the extent of 3 liters, it is plain that not much over 50 calories can be supplied in this way. Conversely, if every particle of food and drink were administered at zero (freezing point), the loss in warming the ingesta would amount to only about 4×37, or, approximately 150 calories. As a matter of fact, cold and warm ingesta ordinarily about balance each other so that the modification of temperature and supply or loss of heat units from this source is insignificant. Thus, practically all the heat and energy of the body are due to the oxidation of food.

Vierordt has calculated that the discharge of heat units is divided as follows:

Urine and faeces, 1.8 %	47.5	calories.
Expired air, 3.5%	84.5	"
Evaporation of water from lungs, 7.2%	182.12	"
" " " skin, 14.5%	364.12	"
Radiation and conduction " 73%	1791.82	"
	2470.	"

Practically all authorities agree that about 88% of the loss of heat units occurs through the skin in one way or another, including that required in muscular exercise. The same fact may also be stated in other words that, with slight muscular exercise the total discharge of heat units through the skin is about 2200 calories or 1000—1200 calories per square meter, the total skin area of an adult being about 2 square meters.

A very practical point in the maintenance of adequate nutrition and in the reduction of obesity is the fact that the evaporation from the skin of a liter of water, signifies the loss of 580 calories (Weintraud). This fact is an additional reason for administering water in the obese, but, in the present connection, it may be pointed out that any excess of water drunk on account of muscular exercise is a rough index to the requirement of calories beyond the standard light exercise ration which does not usually cause sensible perspiration. By measuring the ingested water, the urine and faeces, and allowing 500—600 c.c. of elimination of water by the lungs, we can get a fairly accurate idea of the difference which must pass out by the skin, remembering, of course, to allow for the water of solid food and for the inclusion of the evaporation of insensible perspiration in the standard table above. Various fallacies are involved in such an estimate but it is approximately correct.

If the patient is not taking an excess of watery vegetables and fruits, we may estimate approximately that the watery contents of the solid foods and the water produced by oxidation, balance the loss by the lungs and bowel—providing that there is no diarrhoea. Then, measuring the beverages, we subtract 2000 c.c. for the amount ordinarily eliminated by the skin and kidneys, the caloric loss of which is included in the standard table of Vierordt. The excess represents excess of caloric loss, and is, indeed, very directly seen to be connected with muscular labor and perspiration; every liter of this excess represents a demand for 580 calories.

The nitrogenous output may be estimated approximately by the ureometer. Practically no nitrogen is eliminated by the lungs, (the elemental nitrogen of respired air is, of course, not considered) or by the skin. About 1/7 of the amount of urinary nitrogen is

ordinarily eliminated in the faeces but part of this is alimentary waste. The Hinds modification of the Doremus ureometer estimates the urea about as accurately as any method depending upon the liberation of nitrogen gas, and it should be remembered that such instruments—barring imperfection of reactions— include all non-proteid urinary nitrogen with that formed from urea. Thus, when the instrument reads such a per milleage of urea, it signifies total nitrogen read as urea. 28/60 of the weight of urea is nitrogen. Hence, allowing for the additional loss of body nitrogen in the faeces, every gram of so-called urea eliminated in the urine, represents fully $\frac{1}{2}$ gram of nitrogen, and each gram of nitrogen corresponds to 6.25 grams of proteid consumed in the body. Thus, if the total quantity of urine and the ureometer reading indicate a loss of 20 grams of so-called urea, there has been an oxidation of about 62.5 grams of proteid.

As is discussed elsewhere, the nitrogen elimination is very important in observing the course of diabetes, on account of the tendency to oxidize the tissues. But, in the great majority of cases, those free from wasting disease, and not losing weight rapidly, the ureometer is a valuable clinical index to the amount of proteid actually assimilated by the body. We may even go further and say that unless there is an obvious overeating of proteid foods or marked intestinal indigestion, as evidenced by the passage of milk curds, masses of muscle, etc., or by putrefactive signs the ureometer is a fairly good measure of the proteid ingested. Often, indeed, it is easier to check the proteid ration by the ureometer than by direct weighing and analysis of the ingesta. It should be remembered that, on a standard mixed diet, there is a physiologic waste of about 10% of the ingested proteid.

With the qualifications suggested, and allowing for daily variations, which are not usually great, unless irregular habits give warning, it may be said that a ureometer estimation of less than 20 grams of so-called urea per diem, shows that the proteid assimilation is nearly at the physiologic minimum and that an elimination of 30 grams represents the full allowance of about 93 grams. Under most conditions, the diet should be regulated so as to keep the " urea " elimination close to 20 grams.

CHAPTER VI.

TRANSMUTABILITY AND RESERVATION OF FOODS.

It is obvious that one kind of food cannot take the place of a totally different kind. For example, while one saline may, to some degree replace another in osmotic phenomena, and while various strong acids may be substituted for hydrochloric in gastric digestion, sodium cannot entirely supplant potassium, nor on account of its greater toxicity can potassium take the place of sodium to even so great a degree. The insolubility of calcium salts renders them necessary in the formation of bone, and while magnesium salts are to some extent associated with calcium salts they cannot be substituted to any great degree. It is unnecessary to duplicate these statements for the various inorganic constituents of the body.

Provided that the various essential food ingredients are administered in sufficient amount, and in forms available for assimilation, it is theoretically immaterial in just what natural combination they are employed. For example, water may be entirely, though not advisably, replaced by various beverages and semi-solid or solid foods containing it. Indeed, about 200 c.c. of water is regularly produced in the system by the oxidation of hydrogen in organic combination, especially in carbohydrates, but also in fats and proteids. It is scarcely necessary to state that no one natural food stuff, or group of food stuffs is indispensable, or even particularly necessary for good nutrition, though perhaps an exception should be made of milk in the case of infants.

However, the foregoing statements require qualification in both directions, depending on possibilities of transmutation and on various limitations of theoretic knowledge and on empiricism. For instance, while vegetarianism is possible for protracted, if

not indefinite periods, the entire absence of animal proteids, or even of meats, does not conduce to the best state of health, nor can this fact be entirely ascribed to the lack of the iron of meats. Whether it is due to some essential difference between animal and vegetable proteid—and chemic differences are easily demonstrable, even in the course of digestion—or to the presence in meat of salts or other substances not present in adequate amount or proper proportion in vegetable foods, is not known. We even note empirically that different individuals seem to reach their optimum on different proportions of animal and vegetable proteid, and even on different proportionate use of different groups of flesh, as of quadrupeds, fish and fowl, or of different species of meat, as beef, mutton, pork, etc.

As has been stated, fat is theoretically and, to a large degree, practically replaceable by proteid and carbohydrate. Thus, obviously, no one kind of fat, as olein, palmitin or stearin is indispensable, and these different kinds seem to be entirely vicarious, except as the absorbability depends upon the melting point, so that relatively more stearin is required to replace the others, progressively. To a considerable degree the exact chemic constitution of the deposited fat of an animal depends upon its diet, and may be modified by artificial limitation of diet. To what degree the characteristics of the fat of any animal depend upon essentially specific modifications of its physiologic chemistry, and to what degree it is accidental, depending upon the habitual diet, is not yet determined, but it is not improbable that the latter factor is relatively of great importance, and it may even be that the yellow color of human fat, as contrasted with the white fat of most quadrupeds, is due to the large consumption of fowls and of butter.

It should be stated that the caloric value of the different varieties of fat and of carbohydrates differs slightly, though not enough to be considered even in quite exact studies of calorimetry, owing to the preponderance of other sources of error.

As is shown by a study of physiology, all assimilable carbo-

hydrates ultimately produce simple hexoses, and unless the conditions are exceptional, dextrose. For the first year of life the human being normally uses only lactose, and for about the first six months cannot digest starches. In adult life we find very different individual appetites for starches and sugars respectively, and it is difficult to say how far these are physiologically interchangeable, much less to state how far any one sugar is available for nutrition. Both by practical experience and animal experiment, we know that the various sugars are not desirable substitutes for starch. Whether this fact is to be explained solely on the ground of irritation of mucous membrane, liability to fermentation and difficulty of preventing the passage of too large amounts of sugar into the blood, on account of overtaxing the glycogenic function of the liver, or whether there are more recondite reasons is not known.

Generally speaking, the appetite for sugars and for starch is complementary, the individual who craves cereals, breadstuffs, potatoes, etc., desiring little sugar and *vice versa*, subject to the qualification that the individual appetite for carbohydrates generally is inverse to that for fats and proteids respectively and together, and that the appetite for all foods varies. It does not appear that the craving for sugars is entirely a luxurious appetite, and it may even be that it depends upon a relative—but still not abnormal—weakness of ferments, or even upon relative shortness of the intestine. The consumption of sugar has increased enormously of late years, commensurate with the development of the cane and beet sugar industries (these two sugars being identical with the pure sugar of the maple), and also with the development of the culinary and confectioner's art. It may be considered perfectly normal for an individual to take 100 grams a day of carbohydrate in the form of sugar, and certain persons double this quantity.

While fats are theoretically replaceable by other organic foods, and while it even appears that if absolutely fat-free foods were available, no harm would result from the absolute suppression of the ingestion of fats, this statement cannot be made for carbohydrates. Even aside from the inevitable increase of

nitrogenous waste products from the vicarious use of proteids, and the fact that it is physiologically impossible for the system to increase the digestion and absorption of fats beyond a pretty definite maximum, it appears that about 80 grams of carbohydrate are necessary to prevent catabolic disturbances of a fatal nature.

Proteids, unlike fats and carbohydrates, not only are employed to yield heat and energy but to replace tissues, and are absolutely non-replaceable below a pretty definite minimum, either by fats, carbohydrates, or even non-proteid nitrogenous matter, such as gelatin and purins, free or combined. But, on the other hand, it should be borne in mind that slightly beyond the minimum of 50 to 80 grams a day (the exact amount not yet having been firmly established), proteids not only can but should be replaced by other foods, providing that there is no such obstacle as occurs in diabetes and obesity.

Regarding the transmutability within the system of the different organic ingredients, it has been definitely proved that both proteids and carbohydrates may produce fat, and may be so deposited. It has also been definitely proved that dextrose and glycogen may be formed from fat or proteid, and probably from both, and not only in severe grades of diabetes but in the normal body. Similar information regarding gelatin, etc., is not available.

There is a very general popular notion that a reserve of energy can be accumulated by an excess of ingestion; and this notion is of practical importance, partly because it is measurably true, but largely because it is not true in the crude sense and because it leads to overeating.

Voit has shown that when superalimentation is induced in a dog—barring, of course, gross waste from failure of digestion and saprophytic destruction of food—91.5 per cent. of the carbohydrate that is in excess of the caloric demands is deposited as fat, and 95 per cent. of a similar excess of fat. Exact knowledge with regard to the deposition of fat from proteid is not available.

Deposited fat is the only way in which a reserve of energy of notable quantitative importance can be accumulated. The

human body may accumulate at least 50 kilograms of fat, or nearly 500,000 calories in potential energy, or enough, theoretically, to last the body for 200 days. Unfortunately, when there is a demand for this energy—which rarely happens in civilized life—the body may lack the power to utilize it, and it can never be used without concomitant wasting of proteid tissues. Under no circumstances can the body reserve energy to last for much more than 40 days without renewal of organic nutriment.

Carbohydrates can be stored in the body in the form of dextrose in solution and glycogen in muscle and gland cells, especially in the liver, to the extent of about 300 grams, or barely enough to represent half a day's caloric demands.

A comparatively small amount of proteid in excess of the daily demand for calories can be stored. Voit's experiments on dogs showed that the proportionate storage was about 5 per cent., at most 8.5 per cent., while von Noorden estimated that the human being could thus store 10 per cent. of the excess proteid. In other words, in any day the energy eliminated will amount to 90 per cent. of that ingested in the form of proteid, however much proteid is taken. A very small and not definitely known amount of the reserve proteid occurs in soluble, or at least unfixed form, in the blood and body juices generally. The rest is stored in hypertrophic or newly formed cells. Thus, while proteid may be deposited in forming muscle, and increasing the tissues generally, and while there is obviously so much more tissue that may be available in starvation or relative inanition, there can be no important storage of proteid in the body.

Certain eminently practical deductions can be drawn from these facts. 1. The proteid ration should not be increased with the idea of establishing a reserve of force and tissue material, as such a course leads to increased labor of the emunctories and to an excess of possibly toxic products. It is not, however, established that the ideal diet should include only the minimum of proteid required to prevent loss of nitrogen. 2. The proper normal nutrition of the body requires at least two meals a day. 3. The storage of fat should never exceed the amount which represents the caloric demands of 40 days, about 11 kilograms

beyond the normal minimum of fat required for mechanic packing (not the fat remaining in an extremely lean body)—about 6 kilograms for a man of 70 kilograms total weight. That is, a man of full stature should never carry more than a total of about 17 kilograms of fat, and obesity of more than about 11 kilograms beyond the standard weight can serve no useful purpose, even in the emergency of deprivation of food. 4. While by overeating it is comparatively easy to deposit 250 to 500 grams of fat a day (1-2 to 1 pound), even exposure to cold and muscular exertion in the entire absence of food, can scarcely utilize more than 300 grams of fat a day (a little over 1-2 pound), and while greater loss may occur in sickness, the physiologic reduction of weight on a low diet can never equal the rate at which fat can be deposited, unless for very brief periods.

CHAPTER VII.

WASTE AND DIGESTIBILITY OF FOODS.

Waste of food material occurs both œconomically and physiologically. Not to mention the oeconomic losses in preparing and transporting foods from the original source to the retail market, and the financial waste in using, often through ignorance, expensive food stuffs of less proteid or caloric value than cheaper ones; the trimming and paring of foods in the kitchen and at the table, and the serving of larger portions than are eaten, involves a considerable waste, which must be considered in all cases in which computation of the nutrients is necessary. On the average the waste of digestible and assimilable foods in the kitchen and dining room, amounts to at least 10% and often 50%. Gross waste is often due to lack of care in the cooking and serving of food. Excepting in the commercial sense, the removal of fat, skin, seed pods, husks, cores, and other indigestible parts of crude foodstuffs, can not be considered as waste.

Physiologic waste is due to two main factors—excessive ingestion of one or more kinds of organic nutriment and the swallowing of food imperfectly comminuted. Any vegetable food swallowed in its seed coats, as peas, beans, corn, huckleberries, etc., largely escapes digestion. So, too, starchy vegetables, meats, eggs, etc., swallowed without thorough mastication, are wasted to a large degree. Even milk drunk like water, so as to form large curds, may be passed unchanged. Alimentary saprophytosis, though possibly aiding slightly in the digestion of certain food materials, especially by dissolving cellulose inclosing starch, always causes some loss and often considerable. The efficiency of the various digestive secretions, also has an obvious influence on the amount of alimentary waste.

Granting that digestion is normal, mastication well performed

and intestinal saprophytosis within normal limits, Atkinson estimates the utilization of some of the staple food stuffs, as follows:

Meat and fish. .	nearly 100% of proteid,	79 —92% of fat.	
Eggs.	nearly 100% " "	96% " "	
Milk.	88—100% " "	93 —98% " "	doubtful of carbohydrate.
Butter.		98% " "	
Oleomargarine.		96% " "	
Wheat bread. . .	81—100% " "	(too little fat to estimate.)	99% carbohydrate
Corn Meal.	89% " "	" "	97% "
Rice.	84% " "	" "	99% "
Peas.	86% " "	" "	96% "
Potatoes.	74% " "	" "	92% "
Beets.	72% " "	" "	82% "

Obviously, considerable variations will be found, even in the same individual. Leo Breisacher, for instance, found the percentage of albumin lost 2.9%, 4.9 % and 3.7%, after milk and cheese, and 6.5%, 7%, 7.7% and 12%, after milk alone, in respective experiments.

Percentage of Unabsorbed Albumin, Leo Breisacher.

Corn meal.	15.5%	Peas and bread. .	12.2%	Wheat bread. .	19.9%
Rice.	20.4%	Rye bread.	22.2%	Wheat bread. . .	18.7%
Peas, cooked soft.	17.5%	Black bread.	32. %	Potatoes.	32.2%
Peas, cooked soft.	27.8%	Lentils.	40. %	Potatoes, lentils and bread. . .	53.5%

Percentage of Unabsorbed Fat, Leo Breisacher.

Olive oil (liquid at ordinary temperatures).	2.3 %
Butter (melting point 31 degrees C.)	1.28—6%
Lard " " 34 "	2.5 %
Tallow " " 49 "	7.4 %
Stearine " " 60 "	86.—91 % unabsorbed.

During a fast, a trifle over 1 gram of fat is lost daily in the stools. When 25—40 grams are ingested the loss is 10—15% or about 4 grams. When 100 grams are taken, the gross loss is about the same, the percentage being obviously reduced, and, indeed, the actual loss may be as low as 1.25%. This paradox is undoubtedly due to the fact that, when very little fat is taken, it is mainly in the form of beef and mutton or other meat fat,

and in that of vegetables in which it is imbedded in cellulose, and has a high melting point. Moreover, the less the ingestion of fat, the greater proportionately does the inevitable loss of about a gram a day become. When the fat is increased beyond 150 grams, the loss becomes very great, 20% or more, especially when oils are given that have a direct laxative action.

On a coarse vegetable diet, the waste of all kinds of nourishment becomes progressively greater, also on account of the laxative effect. In general, the finer the sub-division of the food stuff, the greater the utilization of nourishment. For instance, whole wheat bread—except for decortication—yields only 69% of its proteid and 92% of its carbohydrate, as compared with nearly 81% and nearly 100% respectively, for bread made of fine, bolted flour. This fact alone illustrates the lack of sense of the diatribes against fine flours. Potatoes as ordinarily cooked and masticated, yield 70% of their proteid and 92% of their carbohydrate, whereas by serving in the form of a puree, these percentages are increased to 80 and nearly 100, respectively. The coarser vegetables, such as cabbage, carrots, beets, etc., yield at best 60—80% of their proteid and 80—85% of their carbohydrate. If not cooked tender and not well masticated, used abundantly and continuously, the waste may exceed the utilization.

Rubner estimates that on an ordinary mixed diet the waste of nutriment amounts to about 8% of the total calories, under the best physiologic conditions.

For practical purposes, therefore, 200 or 300 calories of the standard ration may be considered to be wasted by failure of digestion. However, as the requirements are usually stated in terms of ingested food required, and as a variation of this amount is not of importance, the physiologic waste of nutriment need not ordinarily be considered. However, variations in waste explain such discrepancies as that two persons of the same size and exercising to the same degree, require different amounts of food to maintain weight.

Normal faeces—amounting to somewhere about 100 grams—contain about 20% of fat and about 7% of albumin ob-

tained by multiplying the nitrogen by 6.25. But the nitrogen is largely excrementitious, that is to say, waste rather than wasted material. Practically no carbohydrate—except cellulose—is present, but, on the other hand, considerable theoretically available carbohydrate, and a less but still appreciable amount of proteid and fat has been destroyed by bacteria.

In various wasting diseases, there is a very practical indication to determine exactly the amount of waste of nutrients in the alimentary canal, although the difficulty and expense of the examination and the fact that the loss by bacterial activity is an unknown element, usually prevent such examinations. However, something may be determined by ordinary chemic tests and by macroscopic and microscopic examination, within the abilities of the clinician.

Digestibility of Foods.

Contrary to the lay impression, it is exceedingly difficult to make a general comparison of foods as regards digestibility. Certain ingredients of diet require no digestion at all, as water, salines, etc. Regarding the digestion of haemoglobin, nucleins, lecithin, organic combinations of iodine as in thyroid, we have no definite knowledge. In other cases mechanic and chemic digestion are of very different relative importance. Carbohydrates and proteids pass through different stages of digestion. For example, a cooked starch is partially digested, both in the mechanic and the chemic sense, dextrin, as in bread crust, is still further digested; the double hexoses, cane sugar, maltose—the next step beyond colorless dextrin in the digestion of starches—and lactose, require inversion into single hexoses and of the latter, dextrose is the ultimate one ready for oxidation, while levulose and galactose require change into dextrose, probably effected by the liver.

While fats are split into glycerole and fatty acids, which combine, respectively, with water to form glycerine and with alkaline bases to form soaps, it does not appear that glycerine and soaps can be considered in any practical sense as nutrients. Indeed, there remains considerable mystery as to the exact nature of fat digestion.

The coagulation of proteid constitutes a preliminary step in digestion. Especially important, because unique, is the provision for the coagulation of caseinogen of milk by rennet. The pancreatic and intestinal juices, as well as the gastric, coagulate caseinogen, although the pathologic instances in which the latter fails to coagulate milk are so rare and are so nearly confined to adults that it is difficult to explain the development of this factor of safety. It is still in dispute whether there is a separate rennet ferment or ferments, or whether pepsin, trypsin and the intestinal activator for tryptic digestion, also coagulate milk. While caseinogen is the only instance of a proteid normally coagulated by the body, egg-albumin is a somewhat analogous, unique instance of a substance which, if not previously coagulated and if given in considerable quantities—5 or 6 egg whites or more—is eliminated to some degree, as a foreign substance, by the kidneys. While the coagulation or analogous change of all proteids by cooking may be considered a step in digestion, it does not appear to be necessary—the principal value of cooking being to kill parasites including bacteria and to render the food more tasty and more amenable to mechanic comminution and softening. Paradoxically, while the artificial coagulation of milk by rennet may be considered a digestive process, it does not seem to add materially to the ease of further digestion in the alimentary canal, while the curd, if allowed to become tough, even if grated into fine particles, is less digestible than raw milk, although not to the degree ordinarily taught.

For some reason, it seems impossible to imitate normal digestion of proteids outside the body. So-called predigested proteid occurs mainly as albumose, and if the process is allowed to proceed to the stage chemically recognized as peptones, the product is not only disagreeably bitter, but is actually toxic. When carried to the stage of amido-acid, it has commonly been stated that the nutritive value has been lost, though this has recently been denied. If so, it would seem that there is truth in the old theory that this stage in proteid digestion represented a natural safe-guard against excessive proteid nourishment, though, of course, not against the toxic effect of the waste products.

Any vegetable food that is rich in cellulose is relatively indigestible, not only in the sense that cellulose itself is not a nutrient, but that many inclosures of starch and other nutrients escape digestion, with variable but considerable aggregate waste. The value of cellulose, especially that occurring in soft, thread-like or netted masses, in stimulating peristalsis must not be forgotten. Similarly, any dense animal structure, such as cartilage and tendon or fibrous tissue, is largely indigestible, and considerable waste also occurs when muscle is not cut, chopped or chewed into fragments at most half a centimeter in thickness. (See discussion of waste of nutriment.)

The older physiologies published elaborate tables of digestibility according to the time required for the stomach to empty itself. Modern research shows that, in the first place, this is not a test of digestion itself—gastric digestion being always incomplete—since the emptying of the stomach depends upon various and exceedingly variable factors, and since, in general, the more quickly food leaves the stomach, the less has it been digested.

E. Jessen found that the muscular fibre had disappeared microscopically 2 hours after the introduction of 6 grams of raw beef or mutton, 2½ hours after the similar introduction of half-done beef or fully-cooked veal, 3 hours after thoroughly cooked beef or pork, 4 hours after beef overdone. Other writers have given shorter times.

W. G. Thompson has compiled the following table of "digestibility," based mainly on the average sojourn in the stomach, those most digestible being given first; the least digestible last. Oysters, soft-cooked eggs, sweetbread, boiled or broiled whitefish, blue fish, shad, red snapper, weakfish, smelt; boiled or broiled chicken, lean roast beef or beefsteak, scrambled eggs or omelette, roast or boiled mutton, squab or partridge, bacon, roast fowl, tripe, brains or liver, roast lamb, mutton or lamb chops, corned beef, veal, ham, duck, snipe, venison, rabbit or other game, salmon, mackerel or herring, roast goose, lobster or crabs, pork, smoked, dried or pickled fish and meats.

Providing that there is not undue stagnation in the stomach, digestive disturbance, and that the faeces contain no excess of

undigested muscle, the exact time of digestion makes no difference and it is better to have the patient eat with relish a slowly digestible meat, such as ham, than to swallow beefsteak as a matter of duty.

It is quite impossible to compare the digestibility of different kinds of foods, for example, meats and fruit. Indeed, it is difficult to express the digestibility of fruits accurately. If not well masticated or otherwise comminuted, there is much waste. If thoroughly broken up, the water and salts are ready for absorption and the digestion of the sugars is a simple matter. There is very little fat present, and it is doubtful whether much of the proteid is assimilated. Bananas must be considered as a class by themselves, since they are the only food in which notable quantities of raw starch are introduced. Obviously, they cannot be digested to any extent until they have passed out of the stomach, but if no fermentation occurs or interference with gastric motility, no harm results from the slow digestion.

CHAPTER VIII.

PREDIGESTION OF FOODS.

The reduction of foods to a homogeneous, soft mass, or to a liquid, is virtually included in any form of predigestion, and, in the mechanic sense, may even be considered as part of the predigestion.

Predigestion of fats, in the sense of forming soaps and glycerine, is not feasible, as those products are nauseating and irritating. Thus, the claim of predigestion of fats in a proprietary food means nothing. The digestion of fats is facilitated by emulsification as occurs naturally in milk and cream. Various mucilaginous and gelatinous solutions may be employed to emulsify fats, or egg yolk or the whole raw egg may be used. Such emulsions are variously flavored. Chocolates, rich in fat, may be considered as solid emulsions, ready for mixing with water, milk or cream. The addition of pure biliary salts to oils, facilitates their osmosis. One part in a hundred may be used.

Predigestion of carbohydrates is partially effected by cooking, the starch granules being ruptured and the starch partially hydrated. Bread crust and toasted bread and crackers also have part of the starch further changed to dextrin. Cane sugar is more or less completely inverted into dextrose and levulose by boiling. However, the simplest and most complete form of carbohydrate predigestion is to administer pure dextrose. While concentrated solutions of sugar are somewhat irritating to mucous membranes, dextrose solutions are less so than those of cane sugar, and the prejudice against grape sugar has no physiologic basis, though, obviously, commercial impurities should be excluded.

Predigestion of proteids is practically limited to the production of albumoses, true peptone being bitter and toxic, at least as artificially prepared. While predigestion may be practiced by imitating either gastric or intestinal digestion or that of certain plants, the method in common use consists in the addition of

pancreatic extract—pure trypsin not having been prepared, at least not on a commercial scale—and an alkali, usually sodium bicarbonate, to milk or a mixture of milk and egg, at about the body temperature. The exact amounts used are immaterial, but a fair allowance is 25 centigrams of each to the pint of milk or egg-and-milk mixture. Digestion is allowed to progress for 20—30 minutes, stopping when the faintest bitter taste has developed. If not used immediately, further peptonization should be stopped by cooling and keeping on ice. Various sealed tubes of peptonizing powder may be used, as a matter of convenience. For domestic use, an ordinary double boiler may be used or the peptonizing dish may be set in a larger one containing water of about the body temperature. With due precautions against too high temperature, the back of a stove, a register, or the top of some piece of furniture in a warm room may be used to maintain a fairly uniform temperature of about the right grade.

While the digestive ferments act somewhat at lower temperatures than that of the body, the so-called cold process (with animal ferments) is not reliable. However, if the alkaline solution of copper used for testing for sugar in the urine shows a distinct violet tinge on adding an equal quantity of peptonized milk, it may be assumed that sufficient formation of albumoses has occurred.

Meat peptonoids are prepared commercially, both in liquid and pultaceous forms. There is no reason why meat should not be peptonized extemporaneously by adding pepsin and hydrochloric acid, about 1 part in 500 of each, or pancreatin and soda as for milk, with due regard to temperature and time, as before. The acid method certainly should not be practiced in a metal dish and, in general, glass or porcelain is preferable for all such manipulations. The vegetable ferments, especially those from paw paw, are more active than the animal, and it is not necessary to secure a decided acid or alkaline reaction nor to maintain the body temperature.

In many instances it seems preferable to practice artificial digestion in the stomach, using alkali and pancreatin if there is a decided lack of gastric secretion, or reinforcing the gastric secretion with hydrochloric acid or pepsin, or both. It should be remembered that the failure of pepsin in the stomach practically

never—absolutely never, so far as the writer is aware—occurs if there is any free hydrochloric acid spontaneously present. Still there are cases in which, clinically, it seems that nutrition is increased by reinforcing the pepsin.

As a rule, stomachs which fail, for more than a brief period, to secrete pepsin, and which do not do so after the hydrochloric acidity is restored artificially, remain permanently apeptic. In many cases, intestinal digestion is fully competent to digest all the proteids and, indeed, the gastric condition is discovered only accidentally and, apparently, after a long time. In others there is gastric cancer, degeneration of the mucous membrane or other serious condition, and considerable irremediable lack of pancreatic digestion. In the former cases, predigestion or concomitant administration of digestants is unnecessary; in the latter it is inadequate and, still, indicated as the best we can do, aside from direct therapeutic measures aimed at the underlying condition.

In the normal hydrolysis of proteids, the first step consists in the combination of albumin with hydrochloric acid, forming syntonin. This method deserves wider use as an artificial form of predigestion. The acid, well diluted, is stirred into the mass, drop by drop. The following amounts of gaseous acid (the official dilute hydrochloric acid is ten per cent strength) are taken up by different food stuffs:

Foodstuff	Grams pure HCl per 100 Grams or 100 c.c.		
Milk	0.32— .42	Graham Bread	.30
Boiled beef	2.	Pumpernickel	.70
" mutton	1.90	Wheat bread	.30
" veal	2.20	Rye bread	.50
" pork	1.60	Swiss cheese	2.60
" sweetbread	.90	Brie cheese	1.30
" calf brain	.65	Edam cheese	1.40
" ham	1.80	Roquefort cheese	2.10
Raw ham	1.90	German beer	.07—.15
Liver sausage	.80		
Cervelat sausage	1.10	Ehrlich.	
Blood sausage	.30		
Mettwurst	1.		

CHAPTER IX.

EMERGENCY METHODS OF INTRODUCING NOURISHMENT.

Physiologic and surgical experiment has shown that, while all the alimentary organs have their use, man can maintain a fair degree of health without mastication and insalivation, without the stomach, without the large intestine, with the bile diverted from the intestine; but the pancreas must discharge its secretion into the intestine and not more than half of the small intestine can be resected without causing gradual failure of nutrition.

Thus it must be understood at the outset that no adequate substitute for normal ingestion can be devised which does not pass the food through at least the greater part of the small intestine.

Feeding Through Fistulae.

The principles of choice of the various nutritive fistulae are discussed elsewhere. When established, the principle of feeding is perfectly simple: Administer enough of the proper kinds of food at suitable intervals. Generally speaking, the food should be the same as would be chosen for any other invalid, it should be as well and as neatly, though not necessarily as daintily, prepared. If it is at all feasible, the patient should masticate and insalivate his own food and spit it into a funnel connected with the fistula tube. Thus, even with regard to taste, the food should approximate that taken in the customary manner. Regarding frequency of feeding, the location of the fistula and the cause for making it must be considered. If a gastric fistula has been established on account of oesophageal obstruction, with no great gastric abnormality, the diet should be in practically all respects the same as in health, with due regard for ease of passage through the fistula tube and with attention to hygienic details which ought to be followed even by those not under medical supervision.

As is discussed elsewhere, a fistula ought not to be made into a stomach that is seriously diseased, especially if the disease is cancer, but a superior enterostomy should be performed. It sometimes happens, however, that the fistula has been made into a cancerous, dilated or degenerated catarrhal stomach, either through an error in locating and diagnosing the exact nature of the lesion, or an unpardonable failure to appreciate the rudimentary physiologic principles underlying the method of attacking the condition, or because of some obstacle to the performance of enterostomy. In such cases the intervals of feeding, the nature of the food, its preparation by predigestion, etc., the use of hydrochloric acid or other digestant, require appropriate modification, and the fistulous opening may even be used for lavage or local applications.

While, theoretically, food introduced directly into the duodenum or jejunum should be prepared to imitate the prior action of gastric digestion, as by artificial digestion with pepsin and hydrochloric acid for an hour or more, such preparation does not seem to be necessary or even advisable. It is, however, necessary to have the food warm and of soft consistency, and it should be introduced somewhat more gradually than through a gastric fistula, on account of the lesser lumen of the intestine and to imitate the gradual, intermittent entrance of food through the pylorus.

In many instances, patients have suffered after the establishment of a fistula, on account of a failure to realize the amount of food and of the various inorganic and organic nutrients required to maintain life. For example—and, unfortunately, these are not imaginary instances—a cancer patient is given two or three hundred c.c. of a proprietary peptone solution in a day, aggregating 10—15 grams of proteid, about the same amount of sugar, and 50 c.c. of alcohol, less than 500 calories altogether, or a child on whom gastrostomy has been practiced for cicatrical closure of the oesophagus is given a mixture of milk and cod liver oil, theoretically adequate in proteid and in calories, but containing far more fat than can be assimilated, so that diarrhoea is produced.

Excepting that the appetite need not be consulted to any

great degree, even more care should be exercised in feeding through fistulae than by mouth. Both to comfort the patient and to secure reflex stimulation of the digestive secretions, some food should usually be taken into the mouth. Whether this same food should be used in feeding or whether it should be spit out and other food substituted, should be determined by carefully balancing the advantage of salivary digestion against the inevitable introduction of bacteria even after the most careful cleansing of the mouth. While, as a matter of convenience, milk, eggs, cereal gruels, meat juice, etc., will usually be employed, the diet should be carefully measured, compared with analytic tables, and criticized with regard to adequacy in water, sodium chlorid, iron, proteid, fat and carbohydrate. The water and salt may be introduced by enema, or subcutaneously, if preferred; and it may even be that water can be introduced by mouth and will be absorbed in sufficient quantity when the oesophagus will not permit the passage even of sufficient quantities of milk, or when the pylorus is almost absolutely closed so that an enterostomy has been required. The general state of nutrition, the examination of the stools, and direct tests of gastric or intestinal juices withdrawn through the fistula, will determine whether predigestion is necessary or not. The following sample dietary is suggested, and may be modified in various ways:

	Proteid.		Fat.		Carbohydrates.		Calories.
Milk, 1000 c.c.	3.3%	33G.	4%	40G.	4%	40G.	670
Wheat flour in gruel, 100 c.c.	8%	8	1.5%	1.5	75%	75	350
Meat juice, expressed 100 c.c.	5%	5	....		....		20
3 eggs		25		15	....		240
Glucose, 50 G.	....		....			50	200
Bovinine, 50 c.c.	25%	12.5	....		10%	5	70
							1550

The above diet is scarcely sufficient, even for a patient in bed, but it is about all that can be given at first. One thousand five

hundred c.c. of physiologic salt solution should also be given by bowel or otherwise. The meat juice and bovinine will probably contain an adequate ration of iron. The latter contains some alcohol, not included in the caloric estimate. In a day or two, 1500 c.c. of milk can be given, which will increase the calories to nearly 1900, and various cereals may be employed, provided that they make a soft mass with the milk.

In emergency methods of feeding, it will be found much easier to maintain good nutrition if the following points are remembered: the introduction of sufficient water, often by a different route from that used for the food; the introduction of 5—10 grams of salt, as such; the daily or occasional addition of fruit juice; the feasibility of employing 50—100 grams of glucose daily. Glucose is most conveniently obtained as a clear, very thick syrup, of 80—90% strength, and therefore yielding 3—3.5 calories per c.c.

Nourishment by Enemata still involves several moot points. One school advocates the use of small injections, 60—100 c.c., at intervals of two or three hours, another of larger amounts, 250—500 c.c., or even more, at intervals of 12, 10, 8 or 6 hours. Some consider peptonization necessary, others not, and among the latter are optimists who regard peptonization as unnecessary because they believe the nourishment to be pretty well absorbed without preparation, and pessimists who hold that even with peptonization, not enough is absorbed to be worth while, so that the method is considered as a placebo. Some add laudanum or some other anodyne or local anæsthetic, as a routine to each injection; others oppose such measures on general principles. Some follow the rule of introducing, in any one day, as much nourishment as possible, by all routes, or, practically, by the two routes of the mouth and the rectum; others hold that, unless in extreme and temporary emergency, one method should be used exclusively, to obtain physiologic rest of the other apparatus. The choice of technic also differs widely.

With so much difference of opinion, it is impossible to avoid personal bias. However, the principles stated are well supported by authority, and it would seem that, in each case, the more

logical or more established of two contradictory views is chosen.

Rectal nutrition never approaches complete utilization of the food introduced. The proportionate waste varies within wide limits, is almost always as much as 50%, and, if the injections are not held for at least an hour, it is practically total. Even under the most favorable circumstances it is not feasible to secure more than about half of the standard degree of nutrition—in other words, it is almost never possible to introduce more than the standard mouth ration by the bowel, nor to have more than half absorbed. While it has been proved that some degree of digestion occurs by means of ferments present in the lower bowel, the process is undoubtedly reinforced by artificial peptonization, or rather by the joint action of the various pancreatic ferments. Considering the inevitable inadequacy of the method in general, every device to secure better utilization of food should be employed. Whether the vegetable ferments, as of pawpaw, are superior to pancreatic extracts, has not been decided. Opium and local anæsthetics are not usually necessary, unless the bowel is exceptionally intolerant or the patient unreasonable. As they certainly check the digestive and absorptive functions, they should not be used unless absolutely necessary, and if tact and gentleness are employed, they may usually be dispensed with, or, at most, need to be used only occasionally. Two or three hours' retention of the enema is necessary to secure any considerable degree of absorption, and double this time is desirable. Hence, allowing an hour for bowel movements after the preparatory cleansing injection, which is almost always necessary, the nutrient injections can not be given more frequently than every three or four hours, and, preferably, every six to eight hours. If this point is granted, it is a simple matter of calculation that the small injections sometimes recommended are utterly inadequate.

It is a matter of experience that rectal feeding cannot be continued for more than a week or two—with rather infrequent favorable exceptions, in which it may be continued even as long as six or eight weeks—without producing intolerance of the bowel. On the other hand, rectal feeding is usually necessary on account

of some gastric condition, such as ulcer, cancer, extreme stagnation from benign obstruction, etc., in which physiologic rest of the stomach is required, and almost as much harm will result from the swallowing of small quantities of food as of the adequate minimum ration. Hence, generally, the advantage of using the combined methods of nutrition is only temporary and specious, and only one method should be used at a time. However, if there is merely a failure of digestive power, as in typhoid fever, or if an operation for the relief of an obstruction is necessary and it is only a matter of securing as complete nutrition as possible for a few days, both methods may be used at once.

While the physician should not deceive himself with the notion that rectal alimentation can ever be physiologically satisfactory, and while, in inevitably fatal conditions, the discomfort to the patient may counterbalance the indication to prolong life, the extreme pessimistic view that rectal nutrition is merely a placebo is not warranted, and this method should be practiced with the feeling that it is doing the best possible under unfavorable circumstances.

If the bowels have been moving freely and there is good reason to believe that the rectum is empty or nearly so, the preliminary cleansing injection may be omitted. Otherwise, as a routine, the rectum should be syringed out with a luke-warm physiologic salt solution about an hour before the nutrient injection is given. After the bowels have been thoroughly cleared out and mouth feeding has been suspended for two or three days, the rectum, in favorable circumstances, retains the nutrient injection for four or five hours or more, and then discharges the residue in one movement, without much indication of putrefaction or fermentation. In such cases, the routine use of the cleansing injection is unnecessary. The physiologic salt solution may still be given to supply liquid to the system, either by the bowel or through the skin, or water may be given by the mouth, according to circumstances.

It is obvious that if small nutrient injections of 60—100 c.c. are used, a piston or simple bulb and tube must be used to prevent undue waste. If, on the other hand, large injections are em-

ployed, the fountain syringe affords the steadiest flow and is most convenient. It is difficult to use the Davidson syringe without waste and without introducing air and stimulating peristalsis by the irregular force employed. All manipulations should be gentle, extremes of heat and cold should be avoided, the buttocks should be held together to reinforce the retentive action of the sphincter, and moral suasion should be employed to secure the co-operation of the patient.

While it is theoretically advisable to introduce the nutrient injection high in the bowel, repeated observations have convinced the writer that catheters and tubes similar to stomach tubes almost invariably turn, so as to discharge downward near the anus, or assume a spiral course so as to reach no higher than the ordinary rectal tip, and that tubes of large diameter and heavy walls, which can neither buckle nor curve in a spiral, cannot be introduced more than four to six inches. Of course, if X-ray examinations, using a stilette or some similar opaque device, or digital touch actually prove the possibility of high injections, they should be employed, but success is extremely rare, good authority to the contrary notwithstanding.

Ewald advises the use of enemata of a bulk of 250 c.c., two or three times a day, diminishing the bulk and increasing the frequency, if necessary. A teaspoonful of flour is cooked with a 20% glucose solution; two or three entire eggs are stirred in after the mixture has cooled enough to prevent coagulation, and 50 c.c. of claret is added. One gram of salt is added for each egg. Three such injections represent about 1500 calories and about 25 grams of proteid. The flour is added rather to render the emulsion of the eggs more complete than for its amount of nutrient. The value of the claret is problematic.

Leube advises the use of scraped lean meat with $\frac{1}{3}$ part scraped pancreas, to secure digestion. The mixture may be further softened by rubbing in a mortar with a little warm water. Salt should be added. If 750 c.c. are given in a day, in three or four injections, by a piston syringe with a comparatively large nozzle, this represents about 150 grams of proteid and 700 or possibly 800 calories.

Blood, milk, eggs; gruels and meat extracts are commonly used in rectal injections. The writer prefers the following: Milk, 250 c.c., 3 entire eggs, peptonized, 50 grams of glucose, 3 grams of salt, three times a day. This represents about 100 grams of proteid and 1400—1500 calories. Beef juice, bovinine, etc., may be used in place of part of the milk once a day, or cereal gruels or proprietary milk foods may be employed.

The conditions in which rectal feeding becomes necessary are: Obstruction, organic or even functional, anywhere along the alimentary canal; diphtheritic inflammation of the throat, post-diphtheritic or other form of paralysis, quinsy, post-pharyngeal abscess, foreign bodies, corrosive inflammation or cicatrical narrowing, various malignant, specific or septic lesions, mainly affecting the pharynx and oesophagus; cancerous, ulcerative, pressure or constricting obstruction of the cardia, pylorus, ileo-caecal valve or intestine generally or, rarely, obstruction by foreign body, impacted gall stone or food remnants, the condition being such as to preclude operation or to afford hope of non-operative relief.

Paralytic, delirious, comatose, insane or hysterical or extremely painful conditions, or prolonged reflex vomiting as from seasickness, in pregnancy, or from gall stones or other more or less remote lesion.

Gastric or duodenal ulcer, acute gastritis, less frequently analogous conditions situated inferiorly, in which physiologic rest is indicated.

Extreme saprophytosis, as in gastric cancer not acting mechanically, and similar conditions of the intestine.

Exhaustion, functional or organic, of the gastric and pancreatic secretions, as in typhoid, shock, Addison's disease, etc. In these cases, some absorption of predigested food may occur from the lower bowel when it would not, if introduced by mouth. There is, here, no objection to simultaneous use of rectal and mouth feeding, as soon as the latter bids fair to be successful.

Intravascular Injections of warm milk were introduced bv Hodder in 1850, to combat the collapse of Asiatic cholera, and have been occasionally employed. The transfusion of human blood may be mentioned under this heading, but it has not been

permanently efficacious in all cases, and several cases of haemolysis have been reported.

Hypodermatic Nutrition has been mainly limited to the use of oil and of physiologic salt solutions. The former has produced embolism.

While hypodermoclysis has proved of value in shock and collapse, it should be remembered that the delay of sterilization can be avoided by introducing the salt solution by the rectum, that a given quantity of liquid can be much more rapidly introduced in this way, that it can be used at a higher temperature (55 C. or 131 F. is the proper temperature according to Fenton Benedict Turck), and that, in many cases in which the rapid absorption of water is required, local stimulation of the kidneys by the hot solution in the bowel, is also indicated. Hence, contrary to the rule for medication, rectal injection should be used in emergent cases, and hypodermoclysis in those in which there is no emergency but in which it is not desired to burden the stomach or bowel—namely those in which introduction of food and drink by the mouth is contra-indicated and in which the bowel is taxed by the introduction of organic nutrients.

Alcohol, and if necessary, gelatin solutions, may be introduced hypodermatically, but rather medicinally than for dietetic purposes. In all cases the gelatin should be boiled for half an hour or more, to insure the absence of tetanus bacilli.

Soluble albumin, if injected either into a vein or into the subcutaneous tissues, acts as foreign matter, at least to a large degree, being eliminated by the kidney. Obviously, too, it can not be sterilized by heat without precipitation nor by chemic means without toxic effects. While serum albumin can be collected aseptically, the danger of haemolysis must be borne in mind. Peptonized proteid, if injected, causes toxaemia, with febrile reaction.

Thus, of all the organic nutrients, carbohydrates alone can be considered available for hypodermatic injection, and, of the carbohydrates obviously, only the sugars, while, of the sugars, the preference should be given to dextrose, as that is the form in which carbohydrates are utilized finally. The writer has, occasionally, for

nearly ten years, employed physiologic salt solutions to which 5—10% of dextrose has been added. After sterilization by heat, these solutions are injected, 500—1000 c.c. at a time, under the breasts or in the abdomen or flanks. 100—300 grams of dextrose may thus be given in 24 hours. No untoward results have developed, nor even glycosuria, owing, no doubt, to the slow absorption and the avidity of the system for readily oxidizable food.

Nutrition Through Unbroken Skin.—Milk baths have occasionally been used, but their value is doubtful. Cataphoresis might possibly aid the passage of nutrients through the skin, but no definite knowledge is available.

Inunction of various fatty substances has been practiced and there is no question but that 30—100 grams of fat or oil may be made to disappear in the skin and when iodized or treated with other test chemicals, the latter have been recovered from the urine, saliva, etc. While it has not been absolutely proved that the fat itself thus introduced, is utilized, this seems altogether probable. As in the case of ingested fats and oils, it is probable that the utilization is directly as the melting point, hence the softer fats or oils, containing relatively more olein and palmitin and less stearin, are to be preferred. On account of the agreeable odor and slight tendency to rancidity, cacao butter is a favorite but cocoa butter, being softer and containing more palmitin, is preferable. Lard, tallow, olive oil, even cod liver oil, may be employed. The last is, obviously, more in use for tuberculosis, especially in young children who cannot protest against the rancid odor. Lanolin and analogous preparations of sheep fat are well absorbed on account of their miscibility with water and it is possible that, by combining with the bacilli, they exert a strictly antibacterial action. Indeed, the freedom of sheep from tuberculosis may be due to their natural fat.

At any rate, it is possible in any case, to administer the full ration of fat through the skin, by inunction, so that the digestive organs may be spared to this extent. Exact metabolism experiments to establish or disprove the dietetic value of fats thus introduced, are lacking.

CHAPTER X.

PRESERVED FOODS.

There is a great diversity of opinion as to the desirability or danger of methods of preserving foods against decomposition. Possibly arbitrarily, it is commonly conceded that preservation by salt, vinegar and oil, and by smoking, is superior to preservation by various other antiseptics. Physical methods of preservation as by drying, hermetic sealing, subjection to heat before hermetic sealing or for brief preservation without sealing, and refrigeration at 4 degrees C., at which point bacteria cease to be active or by actual freezing, are universally recognized as harmless except as they change the physical or chemical characters of food stuffs or allow the impregnation of the foods with toxins or adventitious substances.

The preservation or reclaiming by salting, pickling or smoking of foods already decomposed is obviously to be condemned. Cold storage should not be applied to undrawn poultry, or in general to animal products in which the intestines remain in situ, on account of the impregnation with products of previous internal decomposition. Meats, vegetables, fruits, etc., sometimes seem unaffected by prolonged cold storage, at other times, changes in texture and flavor and perhaps in digestibility occur. There is a common belief that meat should, at least, be kept until rigor mortis has passed off, but that, on the other hand, cold storage for long periods, as months or years, allows all food stuffs to depreciate, even in the absence of demonstrable bacterial changes.

Tainted foods, especially meats, should never be countenanced by the physician, though they are eaten with apparent impunity by some persons. In advising game, fish from a distance and other delicacies for invalids and convalescents, precautions should

be taken to insure freedom from decomposition or else plainer foods should be used.

For ambulant patients with no serious impairment of digestion, chemic or mechanic, salted, corned, smoked and pickled meats (the term pickled is often extended to include meats preserved in brine, though it should obviously be limited to preservation by means of vinegar), are often allowable. While as a rule such meats digest more slowly, if properly prepared, they are practically sterile, and, if appetizing, they tend to stimulate digestion. Well boiled or baked smoked ham, and the fat of salt pork or bacon, properly corned and boiled beef, usually digest as well as unpreserved meats of comparable nature.

Fruits, vegetables, meat and fish, sterilized by heat and immediately canned are especially valuable when fresh products are not available. Economy and convenience have rendered them almost indispensable for domestic use. If good raw material is used, cleanliness is practised throughout the processes of preparation and metal cans and rings for glass cans are free from soluble toxic metals, there is no objection to their free use, and they are even superior to fresh foods of poor quality or that have been shipped for long distances.

Boric acid, borax, salicylic acid for meats, cider, fruit juices, etc., formalin for milk, hyposulphites for meats and canned vegetables, and indeed, every so-called "chemical" preservative have been condemned. On the other hand it has been pointed out that they are not markedly toxic in the small proportions used, and that salt, vinegar, saltpeter and smoke are equally "chemical" and toxic in large dose.

CHAPTER XI.

METHODS OF COOKING.

The use of fire for preparing food is fallaciously regarded as artificial. While this term is literally correct, there is practically no ethnologic nor archaeologic evidence of the existence of a tribe of human beings which has not, even in the earliest times, used fire to some extent in the preparation of food. Even the characteristic failure of the foetal caecum to expand in its distal portion—resulting in the formation of the vermiform appendix, which is not an appendage or outgrowth—is due largely to the use of fire in cooking food, though also to the use of more concentrated food than by the other primates. Thus, to abandon fire for preparing food would be a return, not to the natural state of man, but of the animal from which he evolved.

The value of cooking is three-fold: to kill animal parasites and bacteria, and also, to some degree, to destroy the toxins produced by them; to render both animal and vegetable food more tender and hence more easily digestible; to improve the flavor of food, especially when different natural food stuffs are cooked together.

Probably the most primitive method of cooking is roasting in a fire, and it is probable that the intentional use of this method followed the discovery of the improvement in flavor of meats and vegetables accidentally burned. The use of spits or other support, or the device of first forming a bed of hot ashes or heating a stone, on which the raw food was laid, was an easy advance step. At present the term is usually applied to baking in an oven. Grilling, broiling and toasting are properly included in the term roasting. The surface of the food becomes solidified by coagulation of albumin, usually with more or less charring.

Roasting, as well as the associated methods of cooking, de-

pend upon the action of radiant heat. Owing to the preliminary coagulation of albumin on the outer surface, the juices and volatile flavors of the meat are well retained, nevertheless, 1/5—1/4 of the weight is lost by evaporation. This point should be remembered in quantitative estimates of diet. The surface, if not actually charred, is inevitably rather dry and hard, while, owing to the loss of heat by evaporation, the interior, unless the process is prolonged and the temperature rather high (the standard temperature for baking is about 180 F.) remains rare and may be even raw. While the unevenness of the cooking has its disadvantages in the actual loss or difficulty of digestion of the outer part and the failure to accomplish the prime purposes of cooking so far as the interior is concerned, it has the advantage of suiting different tastes, and, if the cooking is carefully done, both charring and lack of disinfection can be avoided.

In the preparation of meats for cooking, the surface should be wiped with a clean, wet cloth, and rubbed over with salt, with or without pepper and other spices. In the customary method of roasting (baking) in an oven, the meat is placed in a dripping pan with a little water, which is renewed if necessary. Poultry, fish, etc., are usually stuffed with a dressing composed mainly of chopped bread. If oysters, nuts, giblets, etc., are added, they should be untainted, and the possible contraindication to excreting viscera like the kidneys and liver, should be considered. Poultry and fish should be thoroughly eviscerated as promptly as possible after killing, due precautions being taken against rupturing the gall bladder and intestines. The body cavity should also be scalded before stuffing.

All meats should be frequently basted, that is, moistened with the contents of the dripping pan, including the juices extracted from the meat, to prevent drying of the surface during cooking. As a rough rule, $\frac{1}{4}$ hour of baking should be allowed for every pound of meat in a roast, but ovens vary, and pork should be cooked thoroughly, so that no red appears in the interior. By custom, beef is usually cooked less than veal or mutton, but there is no particular hygienic basis for this custom, as mutton is less liable to contain parasites, animal or bacterial, than beef, and,

properly, all meats should be thoroughly done, unless the danger of infection is insured against by careful inspection.

In broiling and grilling, the broiler should be clean and it is generally rubbed with butter. A red mass of coal or charcoal, after the greater portion of the gases have been consumed, is the best fire, but gas does very well. The meat should be turned frequently, and the drippings should be caught on a platter and served with the meat. The thickness of the mass and the degree of heat used cause the same differences in dryness and charring of the surface and rareness of the interior, as in the case of baking. An extravagantly luxurious method of broiling employs an outer blanket of meat, which is rejected, only the rare interior mass being served. After broiling, the meat is usually rubbed with salt and pepper and spread with butter which mingles with the drippings, to form a gravy.

Roasting, now ordinarily called toasting, using a fork or broiling iron, may also be applied to bread, crackers, sliced potato, sweet potato, parsnips, etc.

Boiling.—This process was originally carried on by placing food in a hole in clay, in a hollow piece of wood, stone mortar or dish, or a clay dish, the heat being furnished by hot stones dropped into the water. With the invention of pottery and metal dishes that would stand the effects of fire, boiling is more conveniently carried out by a fire beneath the receptacle.

By a curious paradox the juices of roasted or baked meats may actually boil, whereas, owing to heat conduction, those of boiled meats, practically never do. It is possible only to raise the temperature in water up to the critical point at which steam is formed, and in ordinary cooking, the interior of the mass of meat does not usually rise much above 170. It is commonly stated that, at high altitudes, eggs, etc., cannot be boiled hard on account of the lowering of the critical boiling temperature, but, as human life cannot exist where the boiling point, on account of lessened atmospheric pressure, is beneath the temperature at which albumin coagulates, this statement is incorrect.

In boiling, some of the salts and flavoring matters of food are extracted; hence the water used should be as little as is re-

quired to surround and cover the meat, although fish are usually cooked in a larger quantity, relatively, than meats. In order to minimize the waste, boiling, like roasting and baking, requires a high initial temperature, the meat being placed in water already boiling, and the boiling being maintained vigorously for five minutes, so as to coagulate the albumin of the surface. Then the temperature is lowered. In this process the juices of the meat are squeezed out, the loss being about the same as for baking unless the boiling is prolonged.

Boiling is applied also to a great variety of vegetables, especially when a mingling of flavors is desired. Certain vegetables, such as peas, beans, asparagus, etc., when cooked alone, or in simple combination as succotash (corn with about $\frac{1}{3}$ as much beans) are often served without draining, so that very little water should be used in the process. Dressings of butter or butter and milk, with or without flour, etc., for thickening, may be used.

The Indians have a most delicious method of boiling corn. The corn is cut from the ear, replaced in the husks which are carefully closed so as to be almost water-tight, and, if the process has been properly carried out, the corn is tender and well-flavored and not watery.

Stewing is carried out at a lower temperature than boiling—135—160 F., so as to avoid coagulating albumin. It is applied to various meats and vegetables, often combined, and the extracted nutriment is served with the partially extracted residue. A stew is virtually a thick soup. In so far as the ingredients of both the extract and the residue, are easily digested or are harmless, stews may be employed for invalids, but if greasy, or if rich sauces are added, or if the residue is mechanically indigestible and irritating, it is obviously better to use either nourishment extracted by cooking or nourishment properly prepared in the original food mass. Stewing is the most oeconomic method of cooking, as nothing is lost.

Soups and Broths consist of soluble nutriment, disintegrated shreds of the original food and various ingredients added. A meat broth prepared at a temperature above 160 F., the coagulation point of albumin, contains salts, extractives, which are mainly

excrementitious, and a little gelatin, also some melted fat, although the last is often skimmed off to make the broth more pleasing and palatable. In so far as proteid is concerned, a meat tea made by boiling cannot be more nourishing than egg tea, that is to say, the water in which eggs are poached, or in plain words, it contains no proteid nourishment at all, and is—barring certain qualitative and quantitative differences—of the same dietetic value as urine. Such teas are usually appetizing, and on account of the xanthin-compounds, stimulating in much the same way as coffee, but unless shreds of boiled meat are allowed to remain in the tea, or some other nutriment is added, the gelatin and traces of carbohydrate and fat constitute their sole organic nutriment, and these are not enough to be considered.

A considerable but variable proportion of proteid may be extracted by gentle simmering at a temperature considerably below 160 F., the exact amount of nutriment being determined only by analysis but usually being less than 5%.

Different kinds of soups range all the way from meat teas to meat and vegetable stews, with due allowance for straining or skimming on the one hand, or addition of flour, milk, butter, noodles, vermicelli, etc., on the other. Their nutritive value, therefore, cannot be determined, except by analysis or careful study of the individual composition.

The most concentrated meat broth or soup, involves pre-digestion. The meat is finely minced, and dilute hydrochloric acid is gradually added to saturation (See table, Chapter VIII.) so as to convert the albumin into syntonin. This is extracted by soaking in cold water for several hours. The extract may be con-concentrated by evaporation at 130 F., so as to form a liquid containing about 50% of the meat albumin, or it may still further be concentrated to a jelly.

Braising is a method of stewing in which various vegetables are boiled, and the meat is added at a lower temperature, evaporation being largely prevented by using a covered pot. The liquid should barely cover the meat and the pot should be relatively small. Sherry and various spices are often added.

Frying is convenient on account of the portability of the

apparatus and may be applied to both meats and vegetables, even to cereal preparations, such as mush and fritters. In so far as it is applied to clear fats, it may be used even for invalids, providing that the fat itself is not objectionable. Fat has nearly the same boiling point as water, and the process is much the same as boiling. In order to prevent the penetration of fat, the latter should be hot before the meat or other substance is placed in it. In such cases, if the outer coating of dense and fat-impregnated meat or other food is removed, there is no special objection to its employment even for invalids. As in boiling, the fat, including butter, olive or other oil should, theoretically, envelope the entire food mass, otherwise frying is virtually a combination of boiling and baking. If the fat is burned, i. e., reaches a temperature much above boiling, various disagreeable and harmful by-products are formed.

Generally speaking, double cooking is not available for invalids, warmed up meats especially being liable to be tainted and being rendered tough. However, tough meats may be rendered tender by parboiling before baking and boiled potatoes, baked bread and other cereals, may be further roasted or toasted with advantage. So, too, vegetables and meats already cooked, may be made into purees with cooked flour dressing.

For persons of strong digestion, there is no particular objection to warming or even frying, previously cooked meats. Stuffed fowl, cut up and warmed with the dressing and gravy is more appetizing than when first served.

Steaming, by which method moist heat is applied to cereals, puddings, etc., is practiced mostly on a large scale for the preparation of ready-to-eat cereals and is an excellent method, providing that the mass does not become doughy. The hay oven, the hot covered pit, etc., make use of radiant heat at a comparatively low temperature, applied for a considerable time. By these methods, the albumin may or may not be coagulated and sterilization is complete or incomplete, according to the temperature used, but the effect of the cooking is more uniform than by other methods, and while the flavor of individual viands is not so well preserved,

6

the foods are generally tender. The nature of the food stuffs, the liability to tainting, especially if transported long distances, and the difficulty of regulating the temperature and determining the proper duration of cooking, as well as the temptation to excessive indulgence, has thrown considerable odium on the pit method, as at clam bakes, etc.

Bread Stuffs. Nearly all temperate and tropical climates possess cereals that have been so long cultivated that they are unknown as wild plants. The only indigenous American cereals are a sort of wild rice and corn (maize). The earliest approach to bread-making was the parching by fire of cereals cracked, or more or less reduced to a state of meal in a mortar. The next step was the stirring up of the meal with water—doubtless, at times, with the mixture of salt, eggs, or honey or other syrup—to make a coherent mass which was cooked on a hot stone or some similar plate.

Bread, in the proper sense of the term, was developed among users of wheat, as no other cereal contains so much gluten and, indeed, only a few, as barley, rye and rice, are of a consistency to permit successful "raising." It was probably first discovered by accident that a neglected mass of wheat meal and water became distended by spontaneous fermentation, and that, if baked when in this condition, the resulting loaf was lighter, that the gluten did not cake in the mouth, and that the flavor was improved. Hence arose the general custom of using leaven, that is to say, a mass of sour dough, containing various bacteria and, especially, yeast cells, whose growth in the mass produced various organic acids, alcohol and, ultimately, carbon dioxid which distended the gluten into bubbles. Cooking checks this process by killing the saprophytes, still further lightens the bread by expanding the carbon dioxid, and changes the consistency both of the gluten walls and of the starch.

The importance of bread in the development of the race is well illustrated by the fact that the Hebrews called the Egyptians the Wheat People, and that Moses recognized the danger of an indefinite continuance of a given leaven (that is, of a culture of a given mixture of saprophytes) by directing an annual recourse to

unleavened bread (crackers) and then the starting of a fresh leaven. The proper raising of bread by leaven is difficult and is attended by a freer development of lactic and other acids and of products of bacterial fermentation, than when a pure culture of yeast is employed. In this country, bread raised by leaven is called salt-rising (probably because of a false notion that salt added to flavor the bread was the cause of the rising) or milk emptyings (perhaps because the emptyings or remnants of sour milk were used to start the leaven). It can still occasionally be found in the country and in some cities there has recently developed a moderate market for such bread, because of its delicious flavor. Although the mixed culture of saprophytes, if not killed by heat, is more harmful than a relatively pure culture of yeast, provided this bread is well cooked and, especially if toasted, it may be used to tempt the appetitie of invalids, if they like it.

The success of baking is, however, much more uniform if pure yeast is employed. For persons living at a distance from the source of supply, dry yeast is more convenient. Brewer's (liquid) yeast is more likely to cause the bread to run over—that is to say, there is greater development of carbon dioxid in one part of the loaf than another and, while the irregular, overrun mass has a better flavor, the rest of the loaf is not so thoroughly carbonated. On the whole, the best results are obtained from compressed but soft yeast.

Potatoes, sugar, salt, rice flour—which prevents evaporation by its greater tenacity and hence allows bakers to sell water for bread—fat and various other ingredients are added to bread to assist in distributing the yeast, to facilitate working, or to add to its flavor, but flour, water and yeast are the only essential ingredients.

Owing to its gluten, wheat flour is usually employed, where available, for mixing with rye and other flours, in the making of bread.

Various baking powders are employed to produce gaseous distension of dough analogous to that produced by yeast. There is a general prejudice against those containing ammonium salts and alum, although the latter, according to Witthaus, leaves

alumina, which is harmless. On the whole, those consisting of potassium bitartrate and sodium bicarbonate are preferred, although the routine use of any baking powder which introduces alkaline bases is to be deprecated. The occasional use of baking powder biscuits is allowable. Raised biscuits are the same as bread, but usually the fermentative process is allowed to continue further and the loaves are small.

Aerated bread was much in vogue thirty years ago. It was made by special machinery which obviated manual working of the dough, and carbon dioxid or other gas was forced into the mass. Such bread is theoretically superior, as chances of introduction of harmful bacteria are largely eliminated, and because neither living organisms nor chemicals, other than the gas, are incorporated with the dough. It has a peculiar flavor, not unpleasant to many persons, though it becomes tiresome and, doubtless on this account, its use has lapsed in most places.

Nearly all breads are best eaten after they have stood a day or two, as the gluten becomes thoroughly changed so that mastication does not cause a reversion to the state of dough.

Gluten breads contain relatively less starch than ordinarily found in flour, but it cannot be diminished so as to make any appreciable difference in the feeding of diabetics and, as such breads are more difficult of preparation and more expensive, they are not to be advised, except as an occasional change for the sake of variety.

There is a very general prejudice in favor of whole wheat flour and against the new roller-process flour, as opposed to ground flour. This prejudice is not well founded, as the substances excluded are indigestible and, while of some value as laxatives, their place is easily taken by other vegetable food containing cellulose. However, provided the bran and chaff are not contraindicated, such flours may be used for the sake of variety.

CHAPTER XII.

COMPOSITION OF NATURAL AND COMMERCIAL FOOD STUFFS.

Food stuffs as found in nature or prepared for the market are, with few exceptions, neither pure nor, for practical dietetic purposes, composed of a single organic nutrient, aside from water and inorganic nutrients and waste.

Roughly speaking, the mixed, solid and, in common parlance, dry food stuffs of an ordinary dietary, consist of about 50% of organic nutrients—proteid, fat and carbohydrates—and 50% of water, salts, cellulose and other indigestible waste.

Since the standard minimum diet for an adult at light exercise consists of about 50 grams of proteid, 50 of fat and 400 of carbohydrates, a total of 500 grams, the daily ration consists of about 1 kilogram (2.2 lbs.) of solid food stuffs. Since fats yield the greatest number of calories in proportion to their weight, the most concentrated ration contains the maximum of fats. Even allowing for the ingestion of 150 grams of fats, which can scarcely be digested and absorbed without considerable waste, about 250 grams of proteids and carbohydrates, which have nearly the same calorific value, must be given. Thus the total weight of condensed nourishment is 400 grams and this amount cannot be compressed into a less volume than about 400 c.c., or nearly a pint.

Hence the popular and pseudo-scientific allusions to nourishment by compressed tablets are based on a gross misconception.

Theoretically—and to a considerable degree, practically—it is obvious that if we confine our attention to organic nutrients, proteid, fat and carbohydrate, and ignore indigestible waste and inorganic nutriments, as well as inappreciable amounts of organic

nutrients, all food stuffs may be divided into seven groups, as follows:

A. Food stuffs of a single organic ingredient:
  1. Proteid.
  2. Fat.
  3. Carbohydrate.

B. Food stuffs of two organic ingredients:
  1. Proteid and fat.
  2. Proteid and carbohydrate.
  3. Fat and carbohydrate.

C. Food stuffs of all three ingredients: proteid, fat and carbohydrate.

A. 1. Food stuffs consisting of proteid alone. The white of an average egg weighs 30 grams and contains 20% of proteid, 6 grams in all. Oysters, if the liver is eliminated or if no nourishment has been imbibed, contain 5% of proteid, much less than is commonly supposed. Eight or nine egg whites or 1 kilogram of oysters would furnish the minimum proteid ration.

Expressed meat juice, cooled and skimmed to remove the fat, contains about 6% of proteid, about the maximum contained in any liquid meat preparation.

Beef tea is practically devoid of nutriment, except for small amounts of gelatin, and for coagulated proteid in suspension. It contains stimulant and toxic extractives and is similar in dietetic value to urine.

Artificial proteid foods include those manufactured from meat, those from vegetable albumin, as from the residue of rape seed from which the oil has been expressed. This residue was formerly used merely as feed for live stock. Thirdly, casein preparations, sold under various trade names. The last two kinds of artificially prepared proteid are concentrated and may be valuable additions to a diet for persons of weak assimilation. Such preparations are usually nearly tasteless.

Meat extracts of the Liebig type contain about 1 part in 2000 of proteid and are to be classed with beef tea made at a

temperature near enough the boiling point to coagulate albumin, and with urine.

Valentine's meat juice contains 0.44% of albumin; Starr's 1.10%; Benger's 1.11%; Johnston's 1.17%. (A. H. Chester.)

Peptonized meat extracts consist mainly of albumoses, true peptone being bitter and toxic. Somatose, a granular predigested meat powder contains about 90% of albumoses.

In using any of the proprietary meat extracts or combinations of meat and vegetable nutriment, the stated dose must be ignored, allowance must be made both for the nutritive and toxic effect of any alcohol present (usually about 20%) and the nutritive content must be estimated according to authentic, impartial analyses. These preparations can not be used for exclusive, complete physiologic nutrition, and the best of them scarcely exceed milk or expressed beef juice, respectively, in proteid value.

A. 2. Food stuffs consisting of fat alone. Solid fat meat, as fat pork, mutton and beef fat, contains about 80% of chemically pure fat, the remainder being mostly water. There is about 1% of proteid, but in the form of connective tissue which, though delicate, is scarcely digestible.

Lard, suet and tallow consist of about 85% of pure fats, butter and oleomargarine—which latter is nearly as valuable, though the waste of fat is proportionate to its solidity or, inversely, to its melting point—of about 90%. Olive oil and its substitutes, such as cotton seed oil, peanut oil, etc., contain about 98% of pure fats. Not counting waste in the intestine, which is always considerable if they are given unmixed and in any considerable quantity, these oils yield about 9 calories per c.c.

Cod liver oil contains biliary salts, which facilitate the absorption of fats, but it also contains various excrementitious substances, some iodine and, often, products of decomposition. Except the rather dubious presence of antitoxic or antibacterial substances, it has no greater value than other oils, and it has obvious disadvantages aside from the repugnance of the patient. The need of artificially supplied biliary salts is not established in most of the cases in which cod liver oil is commonly given, and, if demonstrated, these salts may be administered pure or nearly so.

Hence, at present, the wide use of cod liver oil rests on traditional value. Like pepsin, it may be almost entirely eliminated from medical use.

The relatively enormous waste of fats and oils when given in large quantity—over 100 to 150 grams a day—must be borne in mind, also the small absorbability of fats of high melting point, and the cathartic action in preventing the utilization of other foods.

A. 3. Food stuffs consisting of carbohydrate alone. Commercial white sugar consists of about 98% of pure saccharose and, so far as it can be used without producing fermentation and irritation of mucous membranes, it is one of the most assimilable, and both physiologically and commercially, oeconomic foods. It is used, without harm by persons in health, to the amount of 100—150 grams a day, furnishing about 450—600 calories, or $\frac{1}{5}$—$\frac{1}{4}$ of the total needed, at an expense of about 1—1$\frac{2}{3}$ cents a day. Brown sugar is about 97% pure and is relatively more oeconomic. Plain candy contains about 80% of sugar, the water present being physically water, as the molecule of saccharose does not take up water of crystalization. Concentrated white and maple syrups contain about 55% of saccharose. The sugar of the sugar cane, sugar beet and sweet maple is identical, so that adulteration is purely a commercial and not a hygienic fraud. Glucose may be considered as nearly pure, predigested carbohydrate, and, if used in moderation, there is no physiologic objection to it. Laevulose is prepared for diabetics at considerable expense. It can be utilized only to the amount of 20—30 grams, even by a healthy person, without producing glycosuria. Milk sugar is of especial value in feeding infants. Other sugars, though obtainable, are not used in diet.

Tapioca, sago, arrow root and corn starch are nearly pure starches, (95—98%).

B. 1. Food stuffs consisting of proteid plus fat are limited to meats in general, egg yolk, certain cheeses. A few nuts contain a very little carbohydrate.

Muscle contains a small amount of glycogen but as slaughtering is usually done some hours after a meal there is not an ap-

preciable amount present in meat, the principal exceptions being lobster 0.62% and horse meat 1.8%, and the statements in certain tables that meats contain about 1% of carbohydrates, are due to the inclusion of gelatin and extractives as carbohydrates. Inosit does not exist in appreciable amount to be considered even in diabetics. Very lean and usually tough meats contain about 20% of proteid and 1% of fat. Lean beef contains 18—20% of proteid and 2—3% of fat, lean mutton and pork 18% of proteid and 5% of fat, fat beef muscle 17% of proteid and 10% of fat, fat mutton and pork muscle or the muscle with the accompanying fat, 15% proteid and 30% fat. Fat bacon and pork with a strip of lean contain about 8% of proteid and 70% of fat and, as stated, clear fat meats consist of about 80% of fat and 1% of indigestible proteid. The muscle of poultry, fish and shell fish, as well as of rabbits and game generally, corresponds approximately to the analysis of the ordinary meats, goose and duck and the crustacean shell fish such as lobsters and crabs, resembling pork and mutton rather than beef. Smoked ham contains about 20% of proteid and 40% of fat.

An egg yolk weighs about 15 grams and contains 16% proteid and 30% fat, all the fat being in the yolk. An average whole egg contains about 5 grams of fat and 8.5 grams of proteid, corresponding to about 85 calories, a large egg to 100 calories. When taken raw in large quantities part of the egg albumin is eliminated through the kidneys. While 25—30 eggs represent the total ration in calories, 6 represent the standard minimum of proteid, 10 the maximum of proteid and 20 the maximum for the optimum maximum of fat, that is the amount that can be ingested without considerable waste.

Certain cheeses that have been subject to fermentation, lose practically all of the 5% of carbohydrate present in ordinary cheese, and contain about 25% of proteid and 30% of fat.

With reference to the different meats, it may be said that there are certain cases in which the leaner ones are to be preferred, and others for which those richer in fat, such as pork, mutton, veal, tongue, ham, etc., are better. Mutton is least likely to be infected with the cysticercal stage of tape worms or with tubercle

bacilli, or indeed, with any parasite. Beef including veal is especially prone to tuberculous infection and, on account of the size of the animals and the frequency with which horns are present, to septic infection due to traumatisms in freight cars. It also is frequently infected with the cysticercus stage of the corresponding tape worm. Pork is liable to infection with its special cysticercus, when it is called measly, and, of more importance, with the encysted trichina. Thus pork should always be thoroughly cooked and, in spite of the common advice to use raw scraped or very rare beef in feeding convalescents and invalids, the possible danger of tuberculosis to which such persons are susceptible, renders it safer to serve all meats well done. Certain idiosyncrasies or even notions must be respected in regard to meats. On the whole, adult beef and lamb seem to be the most wholesome, but pork is by no means to be excluded and, in general, the taste of the patient is to be consulted. Poultry should be drawn immediately after killing as, even in the absence of infection, the flesh absorbs toxins from the alimentary canal. Bob veal is universally regarded as unwholesome though no definite reason can be found, aside from the tendency to putrefactive change. Young pig does not share this prejudice, possibly because of the prejudice against all pork. The small size of immature lambs removes the temptation to sell bob mutton. Veal changes into beef when milk is abandoned as a food. Game of all kinds is liable to be putrefied and, indeed, is often eaten in a high condition, from a perverted appetite.

B. 2. Food stuffs consisting of proteid and carbohydrate. Lean animal viscera, such as liver, spleen, kidney, thymus, and pancreas may contain notable amounts of glycogen or even dextrose (as much as 10% of carbohydrate for liver if the animal is slaughtered during the period of absorption of food) and 10—15% of proteid with very little fat. All of these are rich in purins and liver, kidney, and probably spleen, are objectionable on account of their special toxins.

Various fruits and vegetables come very close to fulfilling the requirements of this theoretic class. Bananas (average net weight 45 grams) contain 4.8% of proteid and 20% of carbohy-

drate; potatoes (usual weight 50—100 grams) 2 and 20% respectively, and neither contains an appreciable amount of fat. Dry peas and beans contain about 25% of proteid, 2% of fat and 55% of carbohydrate. Macaroni contains about 10% of proteid, practically no fat and 75% of carbohydrate. Bread contains about 8, 1.5 and 50; biscuit (not crackers) 15, 1 and 73% respectively.

B. 3. The combination of fat and carbohydrate is not found in any natural or simple commercial food stuff. Hard sauce is the best example of such a food, consisting of butter and sugar. Buttered potatoes, arrow root crackers, buttered macaroni represent this combination with small quantities of proteid. Various fruits with cream or ice cream also approach this combination.

C. Food stuffs containing all three organic nutrients. While in the strict sense, most food stuffs fall under this category, there will be mentioned here only examples in which no one ingredient can be practically ignored.

Milk contains approximately 4% of each organic ingredient, cream of fair richness 3.5% each of proteid and carbohydrate and 25—30% of fat. Many nuts contain all three organic nutrients in considerable proportions, Crackers contain less water and more fat than bread, averaging 10% of proteid, 5—10% of fat and 60—70% of carbohydrates. Some cereal breakfast foods also contain 5 or 6% of fat.

As cooked or served, by the addition of butter, gravy, sauces, etc., foods tend to be combined so as to represent all three kinds of organic nutrients in appreciable quantities.

The natural appetite also tends to equalize the food taken at any one meal or, at most, within a period of a few days, so as to represent the physiologic standard of nutrients.

Vegetable Foods.

The general principle may be laid down that the ordinary vegetative parts of plants, such as leaves, stalks and roots, contain very minute quantities of any organic nutrient adapted to the use of carnivorae and omnivorae. On the other hand, seeds contain

considerable proportions (approximately 10%) of proteid and still greater proportions (50—75%) of digestible carbohydrate, mainly starch. The edible seeds are mainly limited to the leguminosae (beans, peas, lentils, etc.), and the gramineae (corn of America, rice, wheat, oats, barley, rye, etc., of the old world). Starch in considerable quantities and small amounts of proteid are also found in tubers, such as the Irish potato, tuberous roots, as the sweet potato and carrot and even stalks, roots and leaves when succulent and especially leaves massed together into bulbs, as the onion, may contain appreciable though rather small quantities of nutriment. Sweet, juicy fruits contain very variable quantities of sugar, amounting to about 10—20% as usually eaten, including sugar artificially added. The only common fruit rich in starch is the banana and it is important to remember, with reference to the distinction between ptyalin and amylopsin digestion, that a civilized diet contains appreciable quantities of raw starch almost never except in the form of bananas and chestnuts.

With few exceptions, fat is not stored in vegetable tissues excepting in such as have dense, water-proof seed coats, in other words in what are commonly called nuts or may be closely compared to nuts. The closely related pea and pea-nut, for instance, contain about 1 and 35% respectively, of fat, on account of differences in the pod. The only edible vegetable parts commonly used which are rich in fat and which are not nuts, are the olive, about 25%, the peppers, about 8%, and the cacao bean, about, 50%. Of these, the peppers and cacao bean, in the form of chocolate and cocoa (a curious instance of the perversion of terms, due probably to the similarity in sound between cocoa and cacao) are not eaten in large enough quantities to be of importance in regard to nutrients. The cacao bean is, indeed, as strictly a nut as many other seeds. Per contra, almost the only nut which contains insignificant quantities of fat is the Chinese lichi nut, which is really no more a nut than many other seeds.

The fact is often overlooked that seeds, when ground and cooked, as into bread, crackers, biscuit, Johnny cake, etc., contain practically the same proportions of organic nutrients as before, barring differences due to concentration by drying, minor differ-

ences due to the rejection of the seed coats, and other differences due to the addition of other materials. It should also be remembered that our diet could be greatly varied by the general use of meals and flours prepared from peas, beans, pea-nuts, various other nuts, dried bananas, etc.

A great deal of nonsense has been written regarding the loss of nutrients by the preparation of fine flours, especially by the roller process. It ought to be self-evident that, even if there were a considerable difference in the analysis of fine flour and coarse meal, (and the difference is not very great) the body could not utilize any appreciable amount either of the organic or insoluble inorganic constituents of dense seed coats. On the other hand, the preservation of the teeth of civilized man as compared with savages, is very largely due to the less degree of wear on account of the use of fine flour.

It is largely due to the difference in preparation that much less nutriment is assimilated from oatmeal than from wheat flour, as ordinarily cooked into bread, biscuit, crackers, etc. The scales of oatmeal are also a disadvantage in all forms of alimentary atony and organic obstruction. So, too, even in normal individuals, any cereal which is too finely subdivided to be readily grasped in the peristaltic act and yet consisting of particles too dense to be readily softened by the digestive juices, is slow of digestion and tends to remain for a long time in the stomach. Certain cereal breakfast foods, though rich in nutrient are, on this account, of very little value, unless subjected to additional steaming and cooking.

As a general rule, any vegetable product which cannot be reduced to a fairly soft pulp by several minutes' mastication, is not in a state to be well assimilated. So, too, barley as in soup, huckleberries, green peas, kernels of green corn, etc., swallowed whole, are very likely to pass through the bowels almost without digestion. Sometimes the waste of nutriment in this way is very considerable.

Mushrooms. The most frequently used mushroom, ordinarily called "common mushroom" is the Agaricus campestris. Others frequently used are the horse mushroom (Agaricus arvensis), Fairy ring mushroom (so called from the mode of growth of

colonies, Marasimus oreades), puff ball (Lycoperdon cyathiforme), cepe (Boletus edulis) common in France, shaggy mushroom (Coprinus comatus).

The only way to distinguish between poisonous and non-poisonous kinds of mushrooms is by attaining familiarity with the appearances of the various kinds, either by technical botanic study or practical horticultural methods. There is no simple chemical test (such as the darkening of a silver spoon) or rule of macroscopic appearance (such as the presence of a cup or of a distinct color) which will exclude poisonous species without also excluding many that are valuable and harmless.

McIlvane has found about 300 native species to be safe and habitually uses about 100 species, which can be found all through the year except in winter. Excepting the amanitae, he considers that any mushroom which has a pleasant odor and taste and a firm texture when raw, may safely be eaten. Even the amanitae, if peeled and scraped and then boiled in salt water and afterward steeped in vinegar, may be freed from poisonous properties but, on account of the large number of naturally safe mushrooms, it is better not to trust to any such method.

The mushrooms sufficiently poisonous to be dangerous are: Amanita phalloides, whose indecent appearance is well indicated by the name; A. citrina, A. verna (most poisonous of all mushrooms), A. virosa, A. muscaria (fly mushroom), and A. pantherina; Volvaria gloiocephala; Lactarius torminosus, L. rufus, L. zonarius and L. pyrogalus; Russula emetica, R. quelectii, and R. foetens; Boletus felleus, B. satanus, B. erythropus and B. luridus; Entoloma lividum.

Mushrooms may be fried, baked, stewed, broiled or otherwise cooked and are often used to prepare gravies for meat. While agreeable as relishes, they are not of great food value. About half of the nitrogen is in non-proteid form. The common agaricus contains about 3.5% of proteid, 1–5% of fat and 3.5—6% of carbohydrate. Being light and bulky, and yielding only 30—50 calories per 100 grams, they can scarcely be eaten in sufficient quantity to be seriously considered as foods.

Allied to mushrooms and included in the general group of

fungi, are truffles, subterraneous plants, mainly of the genus Tuber, which are commonly gathered by specially trained pigs or dogs, which turn the truffles out of the ground by the sense of smell. The uncertain yield and expense of harvesting them, renders them extremely expensive so that they are rarely used to any great extent. Their food value is about the same as of mushrooms.

Vegetables and Fruits.

Nearly all the vegetable products eaten fresh, have marked antiscorbutic properties. Many are diuretic or laxative on account of salines and most are laxative by reason of the cellulose contained. Some are distinctly medicinal, even when in common use as foods, as garlic, celery, etc., although any marked medicinal virtue is necessarily accompanied by toxic possibilities which should and usually do preclude use as a food. As a matter of convenience, vegetable food stuffs may be classified as innutritious, as furnishing notable proportions of all organic foods or as limited in value chiefly to one class of organic foods or to some special inorganic material. Such a classification must be understood as being merely approximate. The writer classifies as innutritious, all substances containing, on the average, less than 5 per cent. of any organic nutrient. In general, these vegetables and fruits contain no saline or other mineral matter of special value. The analyses chiefly followed are those of Atwater and Bryant for the U. S. Department of Agriculture as applied to the macroscopically edible portion of each article. Dr. E. W. Allen, Acting Director, has shown the utmost courtesy in supplying information and references for this compilation and the warmest gratitude both of readers and the writer is due to him.

Innutritious Vegetables and Fruits.

Asparagus, cabbage sprouts, cauliflower, celery, cucumbers, beet greens, lettuce, rhubarb, sauer-kraut, spinach, tomatoes, are practically devoid of organic nutrient value. Cabbage, egg-plant, kohl-rabi, leeks, okra, pumpkins, radishes, contain very nearly 5 per cent. of carbohydrates, exclusive of fiber.

Carbohydrate Vegetables and Fruits, Containing Less Than 5 Per Cent. of Other Ingredients.

Artichokes, 15—16 per cent. of carbohydrates; beets, 2—15 per cent.; carrots, 6—11 per cent.; dandelion greens, 10 per cent.; turnip greens, 6 per cent.; onions, 3—14 per cent.; parsnips, 8—16 per cent.; potatoes, 13—26 per cent.; rutabagas, 5—9 per cent.; squash, 3—15 per cent.; turnips, 2—20 per cent.; sweet potatoes, 16—45 per cent.; apples, 8—20 per cent.; apricots, 13 per cent.; yellow bananas, 16—30 per cent.; blackberries, 7.5—16 per cent.; cherries, 11—20 per cent.; cranberries, 8—9 per cent.; currants, 12 per cent.; figs, 18 per cent.; grapes, 15 per cent.; huckleberries, 16 per cent.; lemons, 7—8 per cent.; muskmelons, 7 per cent.; nectarines, 16 per cent.; oranges, 1—18 per cent.; pears, 11 per cent.; persimmons, 30 per cent.; pineapples, 9 per cent.; plums, 20 per cent.; pomegranates, 17 per cent.; prunes, 18 per cent.; red raspberries, 10 per cent.; black raspberries, 12 per cent.; strawberries, 4—10 per cent.; watermelon, 6 per cent.; whortleberries, 10 per cent.; (Note.—Inquiry of the Department of Agriculture has failed to elicit the distinction between huckleberry and whortleberry, the executive office reporting no knowledge of the discrimination made by the analysts. Ordinarily, the terms are used indiscriminately and sometimes include the blue-berry.)

Dairy Foods.

The various industries connected with the use of fresh milk or its products are among the earliest and most important in the history of civilization. The lack of mammals which could be domesticated and which would yield milk in captivity was one of the greatest handicaps of the American continent as compared with the old world, not only in preventing agricultural and industrial development but in increasing the mortality of infants and adults in a state of disease or weakness requiring readily digestible food.

The insurance of a good milk supply involves the following main points:

1. Efficient general inspection of herds to prevent tuberculosis and to secure condemnation of tuberculous animals; also to detect local disease of the udders and appendages, to regulate breeding, transportation and feeding and housing of cattle or other milch animals.

2. Similar inspection, mainly by local municipal governments, to assist in the same items and to insure cleanliness and prompt delivery of properly sealed containers.

3. Ordinary cleanliness and care in handling animals, milking and in other details.

4. Prompt refrigeration of milk in a dust-free place, immediate bottling under reasonable aseptic precautions, continuance of refrigeration until delivery and, by domestic management, till used. In spite of such precautions, milk should be used as soon as possible after being drawn. Under ordinary conditions, it is possible to deliver milk in sealed containers, at a retail cost of five or six cents a quart, and with a bacterial content of not over 10,000 per cubic centimeter. Even when sold at fancy prices by hygienic dairies, lapses in care may cause a rise of bacteria to 100,000 per cubic centimeter.

5. General and local inspection should also be practiced to avoid accidental contamination with germs of typhoid, etc., from water used to wash receptacles or with various other specific germs due to sickness in the family of the milkman and other local causes.

Milk mixed from a number of cows is more likely to conform to the average standard. Chances of infection are mathematically increased but, on the other hand, the degree of infection is likely to be less than when a lapse occurs in the handling of one cow's milk. Provided that systematic inspection is fairly adequate, mixed milk is generally preferable to milk of one cow, even for infant feeding.

COMPARATIVE COMPOSITION OF DIFFERENT MILKS.—BLYTHE.

	Proteid	Fat	Carbohydrate	Ash
Human.....	1—2. %	3—4. %	6—7. %	0.2 %
Cow (G. E. Gordon)..... ...	4. %	3.5%	4.3%	0.7 %
Mare....... ...	2.7%	2.5%	5.5%	0.5 %
Ass......	1.9%	1. %	5.5%	0.4 %
Goat.....	3.7%	4.2%	4. %	0.55%

Providing that care is taken to exclude infection, clean raw milk is superior to sterilized, Pasteurized or preserved milk of any kind.

Condensed milk is of two kinds, one consisting merely of fresh milk, partially evaporated at a temperature sufficient to secure sterilization, and sealed. Such milk analyses about as follows:

Water.....	60%
Proteids...	11%
Fat.......	12%
Lactose.....	15%
Salts.........	2%
	100%

The stronger condensed milks are evaporated to ¼ or less of the original bulk, with corresponding increase of the various solids and with or without the addition of cane sugar, as a preservative. Thus, the proteids, fat and lactose will amount to 15—25% each, the salts to 3—5% and the added cane sugar usually 20—50%.

Completely evaporated milk has been prepared on a small scale as a powder by spraying milk into a hot-air chamber. Unfortunately, the fat tends to melt and to become rancid and physicians are warned against investing in enterprises of this sort unless proved to be practical on a commercial scale. Recently, powdered milk and cream have been placed on the market at prices relatively not much higher than fancy grades of fresh milk. The powdered milk keeps for several weeks, but the cream tends to become rancid and to cohere.

Cream is merely the lighter stratum of milk that has been allowed to stand or has been centrifuged to expedite the action of gravity. According to richness, it contains 20—35% of fat and slightly less proteid and lactose than milk, about 3—3.5%. Condensed cream is also prepared. Clotted or Devonshire cream is skimmed from milk curdled by heat and may be variously flavored with aromatics, combined with eggs, sugar, etc. Whipped cream may be added to fruits, gelatin preparations, etc.

Ice cream theoretically consists of pure cream, sweetened, flavored and frozen, but as made commercially, it usually contains considerable milk and wheat flour, corn starch, etc., or gelatin or eggs are added to increase its consistency. Its food values must, therefore, be computed from the individual recipe employed. A good formula is: Milk 20 parts, Cream 60 parts, Sugar, by weight, 30 parts, Wheat flour, by weight, 1 part rubbed up with enough milk or water to make a paste, Vanilla, chocolate paste, etc., enough to flavor; about 1 whole egg to the pint.

Under certain conditions, not well understood, but according to Victor C. Vaughan, requiring infection with colon bacilli, various milk products and especially ice-cream and creams mixed for pastry fillings, are liable to develop tyrotoxicon and to be dangerous to life. The bacterial activity is not necessarily or even usually attended with obvious fermentative or putrefactive changes, so that there is no warning of the danger aside from the probability or definite knowledge that the milk products are not prepared in a cleanly way or that they have been kept too long.

It should be clearly understood that tyrotoxicon poisoning does not necessarily occur in groups, as at picnics, etc., that there are marked individual differences of susceptibility and that this or some similar poisoning by milk may occur in a mild, protracted form, in infants, typhoid patients and others. Tyrotoxicon poisoning, at least in typic degree, is not especially likely to occur from milk foods subjected to prolonged fermentation, as buttermilk and cheese and it is rarely possible to trace it to butter although it is perfectly possible that many conditions of alimentary saprophytosis may be due to butter.

Butter consists in mechanically concentrated milk fat, with

about $\frac{1}{2}$% each of lactose and proteid, traces of lactic acid, some salts from the milk as well as common salt added. For practical purposes, it may be considered as 90% fat and, hence, yields calories amounting to 8—8.5 times its weight in grams. Since the absorption of fats is inverse to the melting point, butter fat is better absorbed than any other in common use excepting salad oils, the waste being 1—6% under ordinary conditions. Its palatability renders it especially available in wasting diseases, leanness, etc., and, conversely, its high yield of calories in proportion to its bulk renders it especially prone to cause superalimentation and the simpler forms of obesity. 15 grams is commonly considered a rather meagre serving yet this amount at each meal represents a net assimilation of about 350 calories.

Skimmed milk contains small quantities of fat but is, in regard to proteid and lactose, as nutritious as whole milk. Separator milk contains only about $\frac{1}{10}$% of fat.

Buttermilk is the residue of sour cream, after the butter has been removed by churning. It contains about 3% of proteid, $\frac{1}{2}$% of fat and 4—4.5% of carbohydrate. Its acidity is about that of a decinormal solution or a little less, owing to the bacterial conversion of part of the lactose into lactic acid. While highly lauded it should be remembered that it is really nothing but sour, skimmed milk and that there are many instances in which the introduction of an excess of lactic acid and of a culture of lactic acid bacteria is objectionable. It may be used occasionally even in infant feeding, especially when it is desired to overcome virulent putrefactive bacteria.

Koumys is a milk in which lactic acid and alcohol have been developed by fermentation and was originally used (probably on account of spontaneous development of saprophytes, in the leather sacks used to hold mare's milk) by the nomadic tribes of the steppes of south-eastern Europe and western Asia. On account of this origin, the term applies strictly to mare's milk, which is better adapted to this form of fermentation by the relatively high percentage of lactose and low percentage of fat, than is cow's milk. When prepared from mare's milk of a breed producing milk especially rich in lactose, the alcohol amounts to 2% or more. As

ordinarily prepared extemporaneously, from cow's milk, with brewer's or compressed yeast, koumys contains only about 1% of alcohol. At ordinary temperatures, the yeast should be allowed to act for about 24 hours, or until a marked lactic acid reaction and slight effervescence are noted. While it may be preserved by bottling, it is perhaps best used soon after preparation.

For practical purposes, koumys may be considered as an alcoholic buttermilk, available in conditions of saprophytosis with excessive fat and proteid decomposition, hence often in gastric cancer. It is often available in typhoid and other fevers, but should be used according to the taste of the patient and with due regard to the potential disadvantage of a sour, alcoholic beverage. It is relatively less nutritious than milk, bottled koumys sometimes containing not over half the proportion of organic nutrients in milk.

Curd and whey are, respectively, the casein with contained water and salts with other ingredients caught in the curd, and the milk minus the coagulated casein. The coagulation may be produced by souring, as in the preparation of cottage or Dutch cheese or by rennet, as in ordinary cheese manufacture. Coagulation by acidification is usually due to spontaneous, bacterial formation of lactic acid but may be produced by adding lemon juice, etc. So, too, rennet is sometimes allowed to act upon sour milk. Either curd or whey or both may be used as a food, variously flavored with salt, salt and pepper, or sweetened and spiced. Whey contains 1% of proteid in the form of an albumin not coagulated by rennet.

Junket is prepared by sweetening milk with sugar, adding a little light wine or liquor, if desired, curdling with rennet and spicing. Many invalids would prefer unsweetened soft curd and whey with salt.

Cheese curd is commonly considered indigestible and it undoubtedly is somewhat so, on account of its toughness, but it must be remembered that its delicious taste and the difficulty of obtaining it, unless in the immediate vicinity of factories, tempts to overeating. If well masticated or grated, it is not especially indigestible.

Cheese consists of pressed curd, cured by the more or less digestive action of various bacteria. During this action, the lactose is more or less decomposed, forming lactic acid and even alcohol, carbon dioxid, etc., which evaporate. Some decomposition of proteids also takes place. Lard or other fats are sometimes rubbed into cheese and the quantity of fat also depends upon whether cream, cream and milk, ordinary milk or skimmed milk is used as a source of curds. Different kinds of cheese vary considerably in their content of organic nutrients but most contain 20—25% of proteid, 25—40% of fat and from a trace up to 2 or 3% of carbohydrate. The flavor of cheese is to some extent due to foreign ingredients as sage, savory, etc., and somewhat to different strains of microorganisms producing different chemic products. Thus the flavor and the air spaces of Swiss cheese are due mainly to colon bacillus action; a special strain of bacteria causes the flavor of Camembert: and Roquefort owes its flavor to penicillium developing in bread crumbs with which the curd is rubbed up. Limburger is characterized by an excess of strictly putrefactive processes.

While cheese is almost purin-free, the various organized ferments contained, as well as decomposition products and the physical state of the mass, render it somewhat difficult of digestion and prone to occasion alimentary saprophytosis. It may be partially sterilized and the products of germ life already present may be partially removed by toasting and almost entirely so by cooking to form a Welch rabbit (rare-bit is a far-fetched and historically incorrect etymology). The bad repute of this dish is due partly to the tendency to return to a stringy mass but more particularly to the excess of beer, mustard and other condiments, to its use at irregular hours instead of at meal time and to concomitant excesses in eating and drinking. When prepared with plenty of milk or as a cheese custard and eaten at meal time, Welch rabbit is usually well digested by persons of ordinary strength of digestion.

Custards are used mainly by English speaking peoples, and by the French, the Germans having no word for combinations of egg and milk. Whether raw, baked or boiled, they may be vari-

ously flavored so as to take the place of meats or desserts and are highly nutritious. The reputation of egg-nog, a raw custard reinforced with whisky or brandy is exaggerated. The raw egg albumin is not so likely to be assimilated as the cooked and the alcoholic liquor is of doubtful utility in many instances. However, while possessed of no miraculous tonic powers, and representing only the sum of the nutrients and calories of its ingredients, egg-nog is useful in many conditions in which ordinary foods are not well taken, even the liquor stimulating the digestive secretion.

CHAPTER XIII.

ADJUVANTS TO FOODS.

Sodium chlorid, though a true inorganic food and required to the amount of about 10 grams a day, is often used in excessive amounts as a relish. It has even been held accountable for cancer but without sufficient grounds. While it would seem that the formation of hydrochloric acid and the various osmotic processes in which salt takes part might be performed with the quantity ingested as a constituent part of an ordinary diet, almost all races of man and even quadrupeds have a natural craving for salt. Wild animals travel miles to salt licks and domestic animals allow themselves to be caught for the sake of a handful of salt. Whenever a high tax on salt has prevented its use, the health of the people has suffered, though it is only fair to consider that there has doubtless been a dearth of organic food also. Thus, the addition of reasonable amounts of salt to the diet seems justified on physiologic grounds, though the amount ingested altogether should not exceed 20 grams.

See discussion of hyper- and hypochlorhydria and dropsy.

Various spices, notably peppers, mustard, etc., are commonly used in preparing food and some persons use an excessive quantity. It is possible that even moderate amounts, long continued, may induce sclerosis of the liver, kidney, etc., while larger amounts undoubtedly cause gastro-enteritis of mild grade. It has been demonstrated that the normal and *a fortiori*, the hyperchlorhydric stomach is stimulated to secrete more hydrochloric acid by condiments. On the other hand, in hypochlorhydria, the intention for which these stimulants are given, usually fails. Hence, it is wise to use all such substances very moderately, although they are of occasional value to relieve nausea and to stimulate appetite and even the secretions, at least of the salivary glands and stom-

ach. Nearly all of the spices are toxic in sufficient dose, myristica (nutmeg, including mace) especially so. Vanilla also produces anaemia and general depression in those engaged in its preparation.

Initiative mental and physical energy seems to depend largely on the presence of purins in the system. These will be considered elsewhere, but in this connection, may be mentioned the close relation of the active principles of a group of beverages to one of the chief excrementitious purins. Xanthin is found in human and other urines; Mono-methyl-xanthin in rabbit's urine; dimethyl-xanthin is theine or caffeine of tea and coffee; tri-methyl-xanthin is theobromine of chocolate. Mate, guarana and cola are practically equivalents of tea and coffee. Thus considerable portions of both continents are supplied with indigenous plants furnishing mild stimulant beverages. Betel nut and coca erythroxylon leaves are also chewed as stimulants.

Contrasting tea and coffee, the former is more apt to cause constipation and chronic gastro-enteritis of mild grade on account of its greater content of tannin, while the latter is more apt to produce cardiac palpitation and nervous disturbance on account of the relatively greater proportion of caffeine. Tea should be prepared by infusion with boiling water, not by boiling in water, whereas coffee should be prepared by boiling or, better by percolation or the use of a double celled tank, the upper holding the coffee, the lower the water, which rises by steam pressure as it boils, so as to percolate once or twice through the coffee.

The proportion of caffeine varies considerably in different samples and the beverage is, of course, of very different strengths, according to the amount of tea or coffee used and the time allowed for infusion or decoction. Thus, a cupful (about 200 c.c.) may contain anywhere from one to ten centigrams of caffeine, on the average two or three.

Cacao beans contain, both in the coats and the kernel, about 2% of theobromine. The best grades of bitter chocolate contain about the same amount, while the proportion in sweet chocolate, the mucilaginous cocoas, etc., varies according to the amount of sugar, meal, etc., used in making up the mass. Chocolate is best made by rubbing up the cake with water, to make a soft paste and

stirring this evenly into hot milk or equal parts of hot milk and water. A cupful of chocolate or cocoa may contain anywhere up to 30 centigrams of theobromine. As compared with caffeine, theobromine is more diuretic and less powerful either as a primary cardiac stimulant or secondary cardiac depressant. For some reason, it is less likely to cause a pathologic habit, although the use of chocolate either as a beverage or in the form of the sweet or bitter cake or of the beans, and to a serious degree, is not rare and the effects are very much the same as from coffee but almost entirely limited to alkoloidal poisoning, there being relatively little tannin.

For various reasons, tea, coffee, and chocolate are used to stimulate intellectual and physical activity and to replace food. The most harmful effects are seen in poor working women who economize on food and keep a strong decoction (not infusion) of tea on the stove, consuming considerable quantities both of theine and tannin during the day.

The most justifiable use of these adjuvants to food is in some emergency, requiring physical exertion, exposure to extreme cold, or mental keenness. A shipwreck, a battle before which there is no time for preparing a hearty meal, a labor case—either for the patient or physician—, an examination, are examples. On account of portability and considerable organic food value, cakes of sweet chocolate, which are also convenient on account of allowing quite accurate estimation of theobromine content and caloric value, should not be forgotten in such emergencies. The medicinal use of these stimulants, mainly strong decoctions of coffee, in opium poisoning, shock, etc., need only be mentioned.

The principal danger of these stimulants is their habitual use to stimulate the fatigued brain and muscles in the morning, to continue such stimulation during the day and to postpone the natural feeling of drowsiness in the evening. Especially senseless, is the serving of coffee at the close of social functions, after the excuse for stimulation has ceased to exist and with the result of rendering the individual wakeful when he has a chance to sleep.

The low proteid ration of Dr. Chittenden seems to have been rendered possible, partly by the use of coffee and tea. There seems

to be no question but that it would be better to use the same or even a considerably greater quantity of nitrogen in the form of proteid. In this connection, it may be remarked that tea and coffee and even chocolate, used as beverages, may be ignored so far as nutritive value is concerned, except for sugar, cream and milk employed.

Tolerance and noticeable physiologic effects of these beverages, differ greatly in different individuals. There is a physiologic antagonism between the methyl-xanthins and tobacco and alcohol, the former constricting, the latter relaxing the arterioles. Some have claimed that this alternation of effect causes arterio-sclerosis, others have incriminated especially one or the other action. At any rate, the direct influence does not seem to be well established for either set of drugs, either by positive or negative evidence.

While, theoretically, it seems best to abstain entirely from the methyl-xanthin beverages, especially in the case of sedentary livers not exposed to emergencies of any kind, practical experience shows that most persons can take reasonable quantities of them, say three cupfuls of rather weak tea and coffee together, in the course of a day. The addition of milk or cream tends to precipitate both tannin and caffeine. The real flavor of either tea or coffee is best enjoyed from weak beverages. The use of enough tea, coffee or chocolate merely to flavor milk, gelatin, custard, ice cream, etc., often enables the administration of greater amounts of nourishment than would otherwise be possible and is therefore allowable even when there is contraindication to the use of notable amounts of these beverages.

Tobacco is indigenous to America but was not used by the aborigines of the temperate regions except in very small quantities and mainly as a ceremonial. A most curious side light on human nature is afforded by the fact that pipes are rare articles on prehistoric Indian village sites but are plentiful on sites of the transition period in which the Indians came under European influence.

Tobacco chewing almost inevitably results in chronic gastritis, its devotees vomit readily from nervous and mental causes and their appetite is diminished. Disgust for tobacco usually occurs during any acute illness and still the patient is handicapped not

only by the digestive disturbance but by the lack of support of the indulgence.

Cardiac palpitation and possibly even muscular degeneration is liable to occur from the excessive use of tobacco in any way and great individual differences in tolerance are noted. Inexplicable differences also exist with regard to different degrees of tolerance for different grades of tobacco and to its use in pipes, cigars and cigarettes. It should be borne in mind that while the effect of tobacco is nearly the same for all methods of use, chewing actually introduces nicotine into the system while smoking decomposes most of the nicotine, the depression being due mainly to carbon monoxid and cyanogen compounds and in cigarettes, often to acrolein due to the oxidation of glycerine added to prevent drying.

Paradoxically, it often happens that mild tobacco, as in the form of cigarettes, produces more harm than strong tobacco, as in cigars and pipes, because the former are inhaled. A practical distinction must be made between the craving for tobacco effects, for the flavor of the smoke and a mere habit of passing the time. Dry smoking may amount to tobacco chewing or may be a harmless pastime. Many persons dislike the effect of even the flavor of tobacco, yet amuse themselves with lighted cigars and cigarettes which are held mostly in the fingers or which are puffed outward when held in the lips. The absorption of nicotine also differs according to whether the butt is kept dry or is moistened with saliva and drawn into the mouth. An old pipe becomes impregnated with nicotine and other condensation products from the tobacco, so that its effects are liable to be greater than those of a fresh pipe or a cigar or cigarette.

By rolling absorbent cotton into the end of a cigarette or placing it in a mouthpiece, considerable quantities of smoke may be filtered out.

While the evil effects of excessive use of tobacco, especially by the young, are incontestable, practical experience shows that moderate use of mild tobacco by adults is not especially harmful. One or two mild cigars or ten or fifteen cigarettes—remembering that the cheaper American grades are less harmful than the more

expensive Turkish and Egyptian tobaccos—may usually be allowed. On the whole, it is less harmful to smoke than to be subjected to intense nervousness and, even in acute sickness, it is often advisable to allow slight indulgence in tobacco.

The use of tobacco is often preferable to the habit of eating between meals or of indulging in alcoholics and soft drinks. On the other hand, a man who indulges himself in one way is likely to do so in others. The anaphrodisiac action of tobacco is often valuable to combat the nervousness of enforced continence.

Alcoholic beverages may be divided into those produced by the fermentation of malted grain—beer, ale and porter—; those produced by fermentation of fruits—wines from grapes, cider from apples and other beverages occasionally made from other fruits—; and those produced by distillation of fermented grain or direct fortification with alcohol.

Of the malt liquors, beer contains 1.5—5% of alcohol, some dextrin and maltose or glucose and a little proteid. Porters and mild ales contain about 6% of alcohol, Scotch ale 9%. The carbohydrates vary inversely as the alcohol. Malt liquors contain .4—1% of nitrogen, and variable quantities of lactic, succinic and acetic acids and are often still fermenting.

Red wines owe their color to the maceration of the skins and contain considerable tannin while white wines are prepared from the pulp and contain practically no tannin. The amount of sugar present depends partly upon the original content of the grapes, partly upon the stage at which the fermentation of sugar into alcohol is stopped. All wines contain tartrates. Of less than 12% alcoholic strength are claret, Sauterne, Rhine, Moselle, Burgundy, most American, Australian, Greek, Hungarian and Italian wines and champagne. Of about 14—17% strength, are sherry, port, Madeira, Marsala, and some Californian wines.

The sparkling wines including champagne, are bottled while the formation of carbon dioxid is still in progress and, on this ac-account, they are more sedative to the stomach and especially adapted to the treatment of irritable gastric conditions when little nourishment can be taken.

Cider contains 3.5—7.5% of alcohol or more and may be in the form of a champagne. It contains considerable acetic acid and hence, may disagree.

The distilled liquors are of about 50% alcoholic strength. Brandy is prepared from wine, whisky from wheat, rye, barley or corn, apple jack from cider, rum from molasses. Gin is practically a whisky extract of juniper berries. Liqueurs are more dilute and are flavored with various substances: anisette with anise seed, absinthe with wormwood, curaçoa with orange peel, kirschwasser with cherries, being distilled from the fermented mass including the crushed pits; kümmel with cummin and caraway seeds, maraschino with cherries, noyeau with peach and apricot pits. (R. A. Witthaus.)

The spirits contain acetic, butyric, valerianic and oenanthic ethers, and, if not properly purified, amylic alcohol (fusel oil) which is highly toxic, justifying the vulgar term of rot-gut whisky.

It is obvious that, aside from the caloric value of the alcohol, none of the alcoholic beverages possess any considerable nutritive value. Neither are they tonics, except as alcohol in small amounts (under 3%) stimulates gastric secretion or appetite. The malt liquors tend to cause gastro-enteric fermentation and, probably by inhibiting oxidation, the deposit of fat. The stronger alcoholic beverages cause less direct gastro-enteric distress excepting as they produce subacute gastritis, sometimes amounting almost to the acute grade by corrosives. On the other hand, they are more likely to cause hepatic, renal and pancreatic sclerosis and hence, indirectly, gastro-enteric catarrh. On the whole, unless considerable quantities are taken at once, without sufficient dilution with other drink and food, and excepting the obviously greater danger of producing intoxication and its consequences, the strong liquors and wines seem to produce less harm than the malt liquors, or at least, the conditions present are less troublesome and, so to speak, less vulgar.

So large a mass of literature has been accumulated about alcohol and there are so many differences of opinion and so many ethical considerations concerned, that it is impossible to do justice

to them briefly. The following personal opinions may be expressed for what they are worth:

1. Persons in health do not need alcohol at all.

2. Alcohol should not be used before exposure to cold but may be employed in small dose to counteract chill and prevent "taking cold" after returning to a place of warmth.

3. Alcohol is never directly a stimulant in the sense of increasing organic function. In small proportion it increases digestive secretion reflexly through the sense of taste and smell, as well as sometimes psychically, and by local increase of blood supply. The relaxation of arterioles, though strictly speaking depressant, may indirectly increase functional power generally. While alcohol depresses both mental and physical power, the removal of inhibition, fear and prudence, may practically produce stimulation for mental and physical acts requiring no great degree of intelligence or fine muscular coordination.

4. Like tobacco and other depressants, alcohol produces a habit so that the withdrawal of the source of dependence may produce depression. Hence in delirium tremens, in acute fevers, traumatisms, etc., in which there is danger of delirium tremens, the system which is habituated to alcohol should usually not be suddenly and absolutely deprived of it.

5. About 30 grams of alcohol, administered in divided doses, may be oxidized in the body in a day, yielding about 200 calories. There are times when this fact may be of dietetic importance, though rarely.

6. Beer, wines, "beef, iron, and wine," cider and other alcoholics should not be used as tonics or galactagogues, hypnotics, etc., for persons not already habituated. Aside from the danger of producing a habit, much better means are available in each instance.

7. Except as mentioned, alcoholic beverages should not be considered as dietetic agents. Ingredients aside from alcohol

may better be given in other forms, if they have any value at all and often they are decidedly harmful. In all instances in which alcoholic beverages are administered, they should be regarded as Galenical preparations of alcohol itself and the dose should be calculated as for any other drug.

Chewing gum, though a vulgar habit, when indulged in public, is of value to stimulate salivary secretion and, indirectly, even gastric secretion. The incorporation of various aromatic oils is not objectionable but pepsin and other ferments should not be used unless there is a true indication for them. This habit may sometimes be employed as a substitute for those which are dangerous to health, such as alcoholic indulgence, tobacco chewing and smoking.

CHAPTER XIV.

PURIN BODIES.

The former theory as to the production of uric acid in the body was that it represented proteid imperfectly oxidized into urea and that the uric-acid diathesis was a condition of suboxidation, in which the uric acid acted directly as a toxic agent. This view has been considerably modified and it has even been stated that uric acid and allied purin bodies are entirely independent of the catabolism of proteid. Neither uric acid nor any of its congeners are active poisons, but, in excessive amounts, they do exert a detrimental action on the tissues, although xanthin and others of the group seem to be more toxic than uric acid itself. Thus, the general clinical conception of a uric-acid diathesis or better, dyscrasia, may be retained, under the less specific name of purinaemia.

The purin bodies. which are bases with the exception of uric acid, are modifications of the radicle $C_5 N_4$, the common ones being hypo-xanthin, xanthin, uric acid, guanin, adenin, caffeine (or theine), and theo-bromine. As a group, they raise blood pressure and tend to produce angiosclerosis and sclerotic changes in the viscera.

In their most complex compounds, the purins are found as nucleo-proteid, which is split into nuclein and albumin. Nuclein is, itself a compound of albumin and nucleic acid. Nucleic acid is further decomposed into phosphoric acid; a combination of phosphoric acid with a base, nucleotin; a carbohydrate, pentose or xylose; and some modification of the purin radicle. The exact changes of the last are not fully known and differ according to the method of artificial treatment. At any rate, uric acid may be and, in the body, undoubtedly always is to a large degree, produced by the progressive catabolism of nucleo-proteid and part of

this uric acid is further changed, through the stage of allantoin, into urea.

On the other hand, the system can produce its own nuclein and the higher compounds of nuclein, on a diet free from purins but, of course, containing proteids; and the elimination of purins is somewhat increased by increasing the intake of proteids. On an ordinary mixed diet, about half of the elimination of purins is accounted for by ingestion of more or less combined purins and about half by the metabolism of nuclein-containing structures, such as white blood cells and the cells of viscera, such as the kidneys, liver, pancreas, spleen and thymus, etc.

Thus, the extreme theory that no purin bodies are formed except from purins is false and the older view that uric acid is a precursor of urea is true in a limited sense.

Purins derived from ingesta are termed exogenous (better exogenic) and those from the tissues endogenous (better endogenic). The purin bodies themselves are termed free purins, while nucleic acid, nuclein and nucleo-proteids are termed bound purins.

Purins occur in both animal and plant nitrogenous bodies, in greater amount in the former and obviously, in greater amount in glandular viscera and white blood cells than in muscle and connective tissue cells because of the relative preponderance of nuclei. Vegetable nuclein is mainly derived from yeast cells.

The estimation of purins in the urine cannot be determined by the presence of a precipitate of urates—which is rather due to concentration and cooling—nor even by that of uric acid itself. Urine of high acidity (as determined by titration, not by guess) is usually rich in uric acid, not, however, usually in a free state. The normal elimination of purin bases in the urine is about 0.1 gram daily and of uric acid, about 0.5 or a little more. They may be estimated with sufficient accuracy for clinical purposes quite simply by either of two methods. 100—200 c.c. of urine is strongly acidified with hydrochloric acid and allowed to stand for 24 hours, when the uric acid is collected on a filter and its net weight determined by actual weighing. I. Walker Hall's gravity purinometer or R. Harvey Cook's centrifugal method are

based on the same principle, the latter being more rapid and probably more accurate. In the centrifugal method, 10 c.c. of urine is cleared of earthy phosphates by adding $\frac{1}{2}$—1 gram of sodium carbonate and 1—2 c.c. of strong ammonia water and the precipitate is separated by centrifuge. The decantate is treated with 2 c.c. of ammoniacal solution of silver nitrate, prepared by adding to a 5% solution of silver nitrate, ammonia water until the precipitate at first formed, redissolves. More ammonia water is added to make the total bulk 15 c.c. A slimy precipitate is produced consisting of purins in combination with silver. Each $\frac{1}{10}$ c.c. bulk of this precipitate represents (quite accurately according to Ogden) 117.6 milligrams of uric acid per liter of urine. While commonly termed a test for uric acid, it is, according to Hall, one for purins generally. The Hopkins and similar methods, depending upon precipitation with ammonium chlorid and titration with potassium permanganate solution, are tedious, involve many opportuities for accidental loss, shreds of filter paper or other organic substances swell the readings, and the personal equation is a considerable factor.

Since both "urea" as commonly estimated, and uric acid and other purins, depend upon diet to a very large degree, there is no such thing as a standard physiologic ratio between urea and uric acid, although it is not incorrect to say that, under ordinary circumstances, this ratio is about 35:1.

Red meats do not, according to the best authorities, contain notably greater quantities of purins or extractives, than white meats so that the use of fish or chicken breast is not to be urged against the preference of a patient for a chop or steak.

A review of the appended table will indicate the method of regulating a diet so as to increase or diminish the intake of purins. A nearly purin-free diet may be based on eggs, milk and its derivatives, preparations of wheat flour, tapioca, and, in general, the purer forms of carbohydrate and fat, and on fruits and vegetables poor in nitrogen.

In gout, lithaemia, hepatic and renal disease generally and arterio-sclerosis and tendencies to fibroid degeneration, as after middle life, purins should be avoided so far as practicable. In

tuberculosis, there is a general indication to increase the purins as much as possible, even by administering nuclein as such. Whether the use of urea—which in large quantities certainly forms considerable uric acid—is advisable, is doubtful.

Quantities of Purins in Meats, Vegetables and Beverages.

I. Walker Hall, Bristol Med. Jour. June 14, 1902.

	Undried Purins, Grams per Kilo.
Fish—	
Cod	0.582
Plaice	0.795
Halibut	1.020
Salmon	1.165
Meats—	
Rabbit	0.970
Tripe	0.572
Mutton, Australian	0.965
Veal, Loin	1.162
Pork, Loin	1.212
Pork, Neck	0.567
Ham, Fat	1.155
Beef, Ribs	1.137
Beef, Sirloin	1.305
Beef, Steak	2.065
Beef, Liver	2.752
Sweetbread (Thymus)	10.063
Chicken	1.295
Turkey	1.260

Cereals—	Quantity Used	Grams per Kilo	Grams per Liter
Bread (white)	500 Gm.	no trace	
Oatmeal	250 Gm.	0.530	
Rice	500 Gm.	no trace	

	Quantity Used	Grams per Kilo	Grams per Liter
Pulses—			
Peameal	250 Gm.	0.390	
Beans (haricot)	500 Gm.	0.637	
Vegetables—			
Roots and potatoes	1000 Gm.	0.020	
Onions	250 Gm.	0.090	
Tapioca	250 Gm.	no trace	
Green Cabbage	Large head	no trace	
Lettuce	Large head	no trace	
Cauliflower	Large head	no trace	
Asparagus (cooked)	700 Gm.	0.215	
Beers—			
Lager Beer	1000 c.c.		0.1250
Lager Drink	1000 c.c.		0.0500
Pale Ale	1000 c.c.		0.1450
Porter	1000 c.c.		0.1550
Wines—			
Claret	500 c.c.		no trace
Volway	500 c.c.		no trace
Sherry	500 c.c.		no trace
Port, Commendador	500 c.c.		no trace

METHYL-PURINS PER TEA CUP.

	Nitrogen %	Purins %	Total Purins per Tea Cup.
Ceylon Tea	0.164	0.0587	0.0805
Indian Tea	0.147	0.0500	0.0700
China Tea	0.0107	0.0365	0.0460
Coffee	0.0294	0.1000	0.1100

L. B. MENDEL.

	Total Purin N	Free Purin N	Combined Purin N
Meat	.6	.45	.15
Liver	1.2	.33	.87
Thymus	4.5	.42	4.08
Spleen	1.6	.46	1.14

CHAPTER XV.

IMPORTANT CONSTITUENTS OF FOOD STUFFS ASIDE FROM PROTEID, FAT AND CARBOHYDRATE, SALINES AND PURINS.

Medicinal and Toxic Ingredients of Edible Substances.

It is obvious that there is an overlapping of pharmacology and toxicology on the one hand and of dietetics on the other, especially with regard to plants. Tannic acid and certain volatile oils and pigments of more or less positive medicinal action are found, at least in some parts, of nearly all plants used as foods.

The principal vegetable food stuffs containing medicinal or toxic substances are as follows:

Abies nigra, black spruce, is powerfully antiscorbutic. Jaques Cartier used this at the suggestion of the Indians and pronounced it far superior to any antiscorbutic then known to European physicians. However, almost any fresh vegetable or fruit, or decoction of leaves, is more or less antiscorbutic.

Aeschylus hippocastaneum, horse chestnut, is a possible source of starch, if freed from the bitter medicinal principle.

The peppers, spices, etc., are commonly used as food adjuvants for the sake of their flavor and the action of the carminative principles. Nutmeg is especially important as, in sufficient dose, it is a narcotic poison. One nutmeg may kill a child.

Chamomile, peppermint, catnip, sage, savory, saffron, boneset, etc., are often used in the form of teas and while having no very powerful medicinal action nor nutritive value, they might be employed as substitutes for tea and coffee. They are also sudorific and more or less sedative to the nervous system.

Tea, coffee, cacao, mate, kola, etc., are discussed elsewhere, being more or less commonly used as food adjuvants for the sake of a very definite physiologic action of the contained purins. Along with this action, is the inevitable effect of tannin.

Crataegus. Various species of thorn apple are occasionally eaten as fruit. Aside from the astringent and volatile principles, exaggerated claims are made by certain practitioners for the value of tinctures as heart tonics.

Coca erythroxylon. While cocaine and allied alkaloids are entirely distinct from caffeine, the general use of this plant is as a nerve sedative and stimulant, or as a wine, somewhat analogous to the use of tea, coffee, etc. The same may be said of betel nut, and tobacco.

Elderberries are often used like huckleberries or as an adulterant for the latter. Very little of the active principle is found in the berries. The red elderberries are said to be poisonous.

Sarsaparilla is commonly used as a flavor for soft drinks. The medicinal and toxic action of any part of the plant is weak.

Secale cornutum, ergot of rye, ustilago maidis, smut or ergot of corn, and similar parasitic plants, are not themselves used as food but frequently contaminate cereals, giving rise to well known angiospastic conditions, even terminating in gangrene.

Lathyrism is a similar condition, due to the use of the chick-pea vetch. Whether the toxin is a natural constituent of the vetch or due to a parasite is not known.

Pellagra is a peculiar state of physical and nervous depression, nearly confined to the south of Europe and commonly ascribed to the use of green corn made into polenta. It is usually attributed to deprivation of salt but, if so, its apparent relation to corn is unexplained. On the other hand, if due to the corn itself, it would be expected in America, where corn is indigenous and more largely used. It seems probable that some local parasite of the corn is the real etiologic factor. Searcey has recently reported its occurrence in this country, the cereals used being contaminated with fungi and bacteria.

Beriberi is ascribed by some to the excessive use of rice, and some observations have pointed to certain kinds of rice or to rice that has been spoiled by moulds. Others have considered it the opposite of scurvy, due to lack of salines and meats and an excess of vegetable foods generally. The evidence is very contradictory. It may be that the rice is an essential conveyor of some parasite

or that it may be merely accidentally a means of transmitting infection, or even that all apparent relation to food is fallacious.

Asparagus contains an active principle, asparagin, which is a stimulant diuretic, and to some degree, an arterial stimulant and nerve sedative. While contained mainly in the root, it is present to some extent in the stalk. The latter has, therefore, been recommended as an oxytocic and emmenagogue, as a nerve sedative, as a diuretic in dropsy of various forms and as an aphrodisiac. It has been considered contraindicated in certain inflammations of the urinary passages, especially of gonorrhoeal origin. None of these indications and contraindications are of much importance. Asparagin is eliminated in the urine as methyl mercaptan, which has a peculiar disgusting odor. This elimination is noticeable from about one hour up to six or ten hours after ingestion. Aside from the alarm or disagreeable effects due to the ingestion of this article, it may have some value in an occasional medico-legal case. For instance, the presence in the bladder of odorous urine, may decide the time of death, approximately, or may, in connection with other circumstances, help to establish an alibi, throw light on the identification of a corpse or unconscious person, etc. As a combined test of gastric motility, absorption and renal elimination, the time of appearance and disappearance of the characteristic odor is probably as good as any of the usual color and chemic tests.

Lettuce contains a small amount of hyoscyamine and other active principles which act as a mild hypnotic.

Litmus is found in the red cabbage and many of the pigments of fruits and vegetables, as the beet, red apple skin, etc., act as indicators for acids and alkalies. While of no known therapeutic or toxic importance, these color reactions may interfere with the examination of stomach contents, may serve as well as purely artificial separators of the faeces of different days, and may lead to false diagnosis of blood, bile and other colored abnormal ingredients of the faeces.

Hops contain a small quantity of asparagin, a liquid alkaloid, lupuline, and lupulinic acid. Their external use is efficacious partly through the irritation of the last and a true dermatitis

may result from the use of a poultice. Hops are mildly hypnotic and sedative and are sometimes used as an anaphrodisiac, inconsistently enough, in just the cases of gonorrhoea in which asparagus is considered contraindicated.

Bitter almonds, peach pits, cherry pits, etc., yield hydrocyanic acid from the interaction of emulsin and amygdalin, the latter not being present in sweet almonds. The therapeutic and possible toxic action is obvious.

Bananas, especially when cooked, develop a strong odor of amyl nitrite and occasionally produce mild symptoms of vascular dilatation.

Barberries, occasionally eaten raw or made into a sauce or preserve, contain the bitter, yellow alkaloid, berberine, also found in hydrastis and many other plants.

Infusion of beets has been employed as a laxative and as an astringent for haemorrhoids and chronic colitis.

Carrots, parsnips, sweet cicely, celery, anise, caraway, dill, coriander, archangelica, parsley, like all other umbelliferae, contain volatile oils which are poisonous in sufficient dose but which are not much used medicinally. Parsnips are said to be poisonous if used the second year. The bleaching of celery by burying in sandy soil, aids in freeing the stalks and leaves of their volatile oil.

Iceland moss (the candy commonly thus called is merely sugar flavored with anise) beside being used as a nutrient, is of value as a demulcent and is also considered haemostatic, haemotinic and expectorant and is considered efficacious in elephantiasis.

Liquorice, beside containing a considerable amount of sugar, contains asparagin and is used as an expectorant.

Pomegranate rind contains the same liquid alkaloid, pelletierine, as the bark of the root and, therefore, has anthelmintic properties.

Manna is derived from the tamarisk, oak, larch, flowering ash (but only in warm climates) and the Indian Alhagi plant (a legume) and is laxative as well as nutritive.

Pumpkin seeds are anthelmintic but may also be used as food.

Potatoes, tomatoes, and egg plant, like all solanaceae, contain mydriatic alkaloids, but not to any appreciable degree in the

edible portions. However, green parts, even raw potato peelings, may produce mild poisoning.

May apple, occasionally eaten, belongs to the same genus as the officcinal podophyllum and may produce violent catharsis, especially if eaten green or if the rind is eaten.

Horse radish, water cress, mustard, turnip, radish, all contain aromatic sulphur-compounds, which are more or less irritating.

Limes, lemons, oranges, grape fruit, etc., all contain antiseptic oils in the skins and the fruit contains considerable quantities of citric and malic acids, according to its sourness.

Grapes are rich in tartaric acid and the skins in tannin.

Cucumbers, squashes and pumpkins belong to a family pervaded with a bitter, cathartic principle and the occasional gastric distress and diarrhoea especially noted after eating cucumbers seems to be due sometimes to an unusual quantity of this principle, although frequently explainable by fermentative processes.

Wintergreen berries contain some methyl salicylate and cranberries more benzoic acid than is allowed by law in any substance sold for food.

Persimmons, until touched by the frost, are bitter and cathartic.

Pennyroyal, lavender, sage, hoarhound, thyme, spearmint, peppermint, rosemary, catnip, occasionally employed for flavoring, belong to the mint or labiate family, all members of which possess a volatile oil more or less medicinal but not toxic except in large dose.

Slippery elm, a valuable demulcent, is to a slight degree nutritive.

Tapioca and manioc are prepared from the roots of the cassava. The sap is poisonous but is removed by washing.

Various nuts contain acrid, if not actually medicinal or toxic principles in their outer coats.

Vanilla is locally irritating to the skin, conjunctiva, alimentary canal and urinary passages by excretion. It is somewhat aphrodisiac but all of these effects are rare except in those industrially engaged, owing to the minute quantity commonly employed in foods.

Garlic and onions contain allyl sulphid which is expectorant, antiseptic and somewhat irritating. It may produce intense gastro-enteric irritation though the effect is more marked in persons having an idiosyncrasy, which is not entirely explainable as a psychic dislike to the flavor, since symptoms may develop when there is no knowledge of having eaten onions or garlic.

The graminaceae include the grasses and grains or true cereals, the former constituting the principle fodder of stock animals, the latter one of the most important foods of man. Wood states that the whole family contains but one poisonous or even suspicious genus, lolium, but oats are markedly stimulant and aphrodisiac to horses and they contain an active principle, avenin, which seems to be slightly toxic to man, if the use is long continued. Buckwheat, though not belonging among the true cereals, may be mentioned here as liable to produce indigestion and skin eruptions if used to any great extent.

Honey and the flesh of birds and mammals is sometimes toxic by virtue of introduction of poisons from plants. A classic instance is the effect of honey made from laurel flowers upon the army of Xerxes, mentioned by Xenophon. Even buckwheat honey may cause alimentary derangements.

The paw paw and pine apple—not to mention the insectivorous plants not used as food—contain digestive ferments similar to trypsin and amylopsin, acting in alkaline, acid or neutral media, and less sensitive to temperature than animal ferments but destroyed by boiling. Pineapple, however, often lacks any digestive power.

Animal Foods.

No mammal or bird produces substances that are toxic in the practical sense, although all elaborate catabolic substances that are so in about the same relative degree as those of man. While, for the sake of convenience in preparing vehicles, or on account of the value of ferments and nutrients, certain animal products are included in the pharmacopoeia, no animal food stuff is strictly medicinal, in the ordinary sense, and none is toxic in any serious degree, except by reason of essentially accidental circumstances.

Tainted animal foods are dangerous, both on account of living microorganisms and their products. There is a marked prejudice, apparently in most cases, well established by experience, against the use of immature meat, but the reason is not obvious and marked inconsistencies in this regard, exist. Animals and birds that live upon carrion and even carnivorous animals generally, have flesh that is relatively toxic, probably on account of the preponderance of nitrogenous waste.

No domestic fish is poisonous, either as food or by virtue of special secretions, barring accidental impregnation with exogenic poison, tainting and disease. In the West Indies all fish feeding on certain coral banks are poisonous and certain foreign fishes are always toxic, while others are poisonous at the breeding season, as the barbel, pike and barbot, the poison being mainly in the roe. Certain foreign fishes, mainly tropical, also have poison organs more or less analogous to those of serpents, but the flesh is not necessarily poisonous.

So far as known, no mollusc is intrinsically poisonous, either by ingestion or by the possession of special poison organs but accidental impregnation with exogenic poisons or tainting is common.

Many medusae and corals are poisonous but as they are practically never eaten by man, this fact is important only as they serve as food for marine animals of higher rank.

Lizards are not poisonous by ingestion, so far as is known, but certain ones contain poison glands in the skin. However, the only one dangerous to man is the heloderma horridum and the danger of this has been exaggerated.

No crustacean, such as crabs and lobsters, is intrinsically poisonous but idiosyncrasies resulting in gastro-enteric disturbances and erythema or urticaria, are common. Such animals are also liable to accidental impregnation with poison and, more particularly, to tainting. Of the other arthropods (including insects) the only ones at all liable to be used as food are the king crabs of the class arachnids, which are not poisonous, though other orders of the same class include many poisonous centipedes, spiders and insects.

The most highly toxic substances known are included among serpent venoms but the flesh of serpents is never poisonous intrinsically nor is the venom poisonous when ingested, unless in enormous dose or in the presence of solutions of continuity of the alimentary mucous membrane or of failure of the digestive secretions.

Strange as it may appear, no systematic investigation has as yet been made to determine the possible value of plants in medicinal and nutrient properties, although those empirically in use as foods or medicines or having conspicuous poisonous effects have been pretty thoroughly investigated. It is especially to be regretted that the inorganic constituents and those of organic nature but neither proteid, carbohydrate nor fatty, of our common edible plants, have not been thoroughly determined. The same complaint may also be made regarding animal foods.

The following notes, though very incomplete, are summarized from foot notes in the analytic tables of Atwater and Bryant and, to some extent, from other sources:

Lecithin—

7 samples of medium fat, fresh ham, average	0.32%
1 sample of fat, fresh ham, average	0.45%
8 samples of medium fat, fresh pork loin, average	0.35%
8 samples of fresh pork tenderloin	0.51%
8 samples of fresh pork shoulder	0.25%
8 samples of fresh pork sides	0.35%
8 samples of fresh pork clear backs	0.21%
8 samples of fresh pork clear bellies	0.18%
8 samples of fresh pork feet	0.32%
8 samples of fresh pork tails	0.20%

Lecithin is a nitrogenous combination of fatty acids with glycero-phosphoric acid. It is found especially in nervous tissue, yolk of eggs, roe, semen, bile, milk, blood cells and adrenals. It is not known whether it is an excrementitious product or not but it has been advised to prevent the formation and to aid the solution of biliary calculi.

Phosphorus. This substance is a necessary ingredient of bones in the form of calcium phosphate, with a small quantity of magnesium phosphate. Soluble phosphates of sodium and potassium also occur in the blood and body juices generally but it is doubtful whether they are necessary for osmosis or other purposes. Phosphorus is an ingredient of many forms of proteid as well as of lecithin, nucleins and higher compounds of purins and is supposed to be especially important in the nervous system. It is probably necessary to the body in complex organic form, in much the same way as nitrogen, but on a smaller scale.

Fish are popularly supposed to be a "brain food" because of their high content of phosphorus but this notion is largely due to the phosphorescence of decaying fish, a phenomenon produced by saprophytes and probably not in any way connected with the presence of phosphorus. However, fish do contain phosphorus in amount corresponding to about ½% of the total edible portion, estimated as phosphoric anhydride. The same is true of molluscs and crustaceans. The variations are from 1/5 to 7/10% but not enough analyses are available to determine whether the differences are characteristic of different kinds of sea food. Fish do not, in general, contain more phosphorus than ordinary meat.

Egg white contains about 1/100% of phosphorus, egg yolk about ½% estimated as phosphoric anhydride. Milk contains a little over 1 per mille of phosphorus.

Corn and oats contain very minute amounts of phosphorus but rice flour contains 2—3% and wheat flour about ½%, or about half of the total ash. Parsnips contain about 2:1000. Potatoes, ruta bagas and tomatoes about ½:1000; Figs, grapes, lemons, oranges, prunes, about the same. Almonds contain about 1%; chestnuts ½%, walnuts ¾%. The legumes contain very little.

Mammalian brain contains about 2:1000 of phosphoric anhydride and muscle 3.5—5:1000, the latter figure being about the same as for fish.

As a very approximate estimate, it may be said that phosphorus thus estimated, amounts to about ½% of all solid food and that 1—2 kilos of solid food (not of organic nutrients) are eaten daily, so that the total phosphorus amounts to about 5—10 grams

daily. Most of this is eliminated in the faeces as insoluble salts of calcium, and magnesium, the crystals of triple phosphate (ammonio-magnesium phosphate, being visible under the microscope in nearly every sample of faeces of alkaline reaction. About 3 grams of phosphoric anhydride are daily eliminated in the urine (as in other analogous cases, the precipitate being no guide to the amount, but quantitation by titration or centrifugal analysis being fairly easy). Whether it is necessary for health that this amount of phosphorus should be metabolized is not known but it is fair to assume that any great deviation should lead to a revision of the diet or may indicate some perversion of metabolism or elimination.

The phosphorus of vegetable tissues is largely contained in dense fibrous structures, and in insoluble form, so that it is extremely doubtful whether the less refined flours and meals really furnish less phosphorus for assimilation, than coarser flours and meals.

Sulphur. Like phosphorus, but to a less degree, sulphur plays both an inorganic and an organic role in the body, and is a constituent of many forms of albumin.

Fish contain about ½% of sulphuric anhydrid, the same as phosphoric anhydrid, but the limits are greater, up to 1¼% for smoked herring. Allowing for the relative dryness of fish, there is not so much fluctuation for either phosphorus or sulphur and the sum of the two (as anhydrids) amounts usually to very nearly 1% of the total edible portion. There seems to be, however, no constant tendency to either direct or inverse relation of these two ingredients. As in the case of phosphorus, molluscs and crustaceans contain about the same amount of sulphur as fish, usually a little less.

So far as Atwater and Bryant's analyses go, most vegetable foods contain only 1/10—½ as much sulphur as phosphorus. Onions, garlic, mustard and other plants mentioned as containing semi-medicinal principles, contain considerable sulphur in organic combination, as allyl sulphide, etc. Fibrin, egg albumin and casein are particularly rich in sulphur but sulphur is found in most proteids, to the amount of 0.3—2%. Hydrogen sulphid and car-

bon disulphid and aromatic sulphates are regularly formed in the intestine, mainly by the action of colon bacilli but sulphur-containing compounds are also end-products of tryptic digestion.

Corn, cauliflower, turnips and asparagus are mentioned by Thompson as especially rich in sulphates but at least part of the sulphur is in organic combination. Nervous tissues yield about 1—2 parts in 10,000 of sulphuric anhydrid. The commonly used meats of animals and fowls contain only traces of sulphur, horse meat a larger but still minute quantity.

The daily urine contains about 2 grams of sulphuric anhydrid, 1/10 of which is normally in the form of indican and allied ethereal sulphates derived from the intestine. Elemental sulphur is often administered in large doses without much influence upon the urine. Indeed, being somewhat antiseptic, it may even diminish the urinary sulphur by diminishing the ethereal sulphates.

It is obvious that sulphur is quantitatively less important than phosphorus and it is not certain that it is needed at all. At any rate, it is difficult to regulate the diet so as to increase or decrease its rather putative metabolism in the tissues. A very practical dietetic indication exists, however, to reduce the excessive production of sulphur-containing gases due to intestinal putrefaction, both by restricting germ activity and by omitting such foods as are rich in sulphur. As sulphuretted hydrogen precipitates iron, intestinal putrefaction is a cause of anaemia and the medicinal use of much larger quantities of inorganic iron than are needed in the tissues and blood, is of value to furnish iron with which this gas may combine. The occurrence of indicanuria to an excess, demands the control of intestinal saprophytosis, and the avoidance of proteids rich in sulphur or, indeed, of an excess of any form of proteid. Hence, a diet mainly vegetarian (avoiding, however, vegetables rich in sulphur) acts in a double way in such cases.

Chlorine. This substance occurs mainly as sodium chlorid and when, as is commonly the case, 20—30 grams or more are found in the urine not to mention elimination in the sweat and waste in the faeces, it must have been ingested largely as salt added in cooking foods or after they are served. About 10 grams of

sodium chlorid are needed daily and this amount is present in an average, unsalted diet. However, when the diet consists mainly of eggs, milk, and fresh vegetables, some salt is usually needed. Salt, artificially added is found in comparatively large quantities in preserved meats, cheese, canned foods, etc. Generally speaking, any natural food stuff contains the salt required to furnish the chlorine of hydrochloric needed for its digestion but it is empirically demonstrated that even the lower animals require additional salt as such, and that peoples to whom salt is not available by reason of inaccessibility of salt springs or the ocean or on account of taxation, formerly much practiced in Europe, suffer in health.

For practical purposes, the regulation of salt in the diet may be limited to salt as such and highly salted foods. It can always be sufficiently reduced by attention to these factors. To a large degree, a natural appetite is a safe guide. The amount of hydrochloric acid in the stomach contents and the amount of chlorids in the urine (which can be determined with sufficient accuracy for clinical purposes by Purdy's centrifugal method) should also be considered as guides to the use of salt, especially as perverted appetites are likely to be associated with perverted gastric secretion. The elimination of salt occurs very rapidly if an abundance of water is taken.

Iron. Most colored vegetables contain more or less iron, seldom more than 1 part in 10,000. Spinach is said to be especially rich in iron. Mammalian muscle contains $\frac{1}{3}$—1 part in 1000, blood a trifle over 1:1000. According to various estimates, the human body contains a total of 3—7 grams and requires about 10 centigrams a day or about 1 ten thousandth of the total average ingestion of solids. It is probable that there can be no essential excess of iron in the system, although there is a physiologic provision for reserves in the liver, spleen, etc. Neither can an excess of organic iron in the alimentary tract be harmful. Thus, from the standpoint of dietetics, the indication is always in one direction, namely to increase the ingestion unless iron is introduced medicinally or as a gross contamination of food.

As has been intimated the major part of inorganic preparations of iron are precipitated by hydrosulphuric acid in the intestine or otherwise wasted; still it has been demonstrated that normal animals may assimilate inorganic iron. As a matter of fact, cases of anaemia very seldom recuperate iron with any degree of rapidity—excepting in anaemia due to haemorrhage—proportionate to the amount of iron taken, even if a large dose is given amounting to ten, twenty or thirty times the theoretic daily need. In other words, anaemia is not often due to iron starvation and recovery is as likely to take place without as with medicinal iron, providing that the diet contains a reasonable amount of meat, etc.

Acids. Vinegar, some wines and various fruits and their juices contain variable amounts of various organic acids. Although such acids are produced by fermentation, they are, in sufficient strength, antiseptic; indeed spontaneous fermentation is checked automatically when the acidity becomes sufficient to inhibit the saprophytes. Acetic acid of vinegar, citric acid of lemons and related fruits, lactic acid of buttermilk, are sufficiently strong to supplement hydrochloric acid in the stomach or more or less adequately to replace it. Buttermilk usually has an acidity of about 100% as estimated by decinormal alkali, or half as much again as normal gastric contents during digestion.

All of these acids are decomposed with the production of alkaline carbonates, so that the usual tendency is to lower the acidity of the blood and urine.

No systematic investigation of the nature and quantity of acids in food stuffs has been made and such analyses as have been made usually give neither the degrees by decinormal alkali nor the actual content of particular acids, but state the acidity in the equivalent of sulphuric acid or of some acid found in the fruit but not necessarily as the sole acid ingredient. In this sense, fairly tart fruits such as strawberries contain about 1% of acid, lemon juice about 7%, rhubarb ½%, cauliflower 0.6%, cucumbers 0.02%, egg plant 0.01%, potatoes 0.02%.

A great variety of organic acids are found in different fruits and these are, to some degree, mutually convertible in the stomach

or even in the plant itself. Whether or not the introduction of such acids as acetic, malic, propionic, succinic, citric, lactic, etc., which are commonly found in fruits and vegetables, is at all comparable to the results of fermentation in the alimentary canal, with production of the same or closely related acids, is a very important question which has not been decided.

There seems to be no question that oxalic acid should be avoided as much as possible. (See list of oxalic-acid producers in consideration of Renal diseases). It is also to be seriously considered whether the results of gastric fermentation are not largely due to the formation of lactic acid from meats, milk, etc., and, if so, whether the free use of buttermilk, though temporarily beneficial may not have serious after-effects. Apparently oxalic acid may be derived from various organic acids present in fruit or formed by fermentation of carbohydrates. Hence it is often in excess in hypochlorhydria.

It is sometimes said that more persons have an idiosyncrasy toward strawberries than toward any other article of food but whether the erythema and urticaria are due to the acid or to some other ingredient has not been proved.

Generally speaking, highly acid drinks and fruits should be used in small quantities and not before meals. Otherwise, excepting oxalic acid and other harmful ingredients, sour vegetables and fruits may be used freely, according to appetite and individual experience, subject to limitation of indigestible and digestible ingredients within reasonable bounds. It seems probable that the increase of symptoms by an excessive use of sugars and starches in gout is due to fermentative changes culminating in the formation of an excess of oxalic acid.

CHAPTER XVI.

DISTINCTLY DELETERIOUS FOODS.

Parasitic Invasions, including Infections, Due to Food and Drink.

There is a very general opinion that susceptibility to infections depends largely upon the nutrition and vital strength of the system irrespective of any tendency to the conveyance of disease germs by the habits of the individual in regard to diet or other details. A critical consideration of the subject, taking each infectious disease seriatim, has led the author to the belief that there is absolutely no foundation for this opinion, excepting in regard to tuberculosis.

Any parasite, including pathogenic bacteria, may be conveyed by any medium which is not lethal to the parasite. Hence, practically every parasite, using the word in the broadest sense, may occasionally be conveyed by food or drink.

Only two common infections are characteristically conveyed by water—typhoid and cholera—but probably non-specific choleraic diseases, dysentery and various infections of rather limited geographic distribution are also water-borne. Milk and ice and, to a less degree, various food stuffs, especially those eaten raw, may be contaminated through the use of water. In the case of milk, the water may be an adulterant, or infected water may have been used to wash the containers. When typhoid occurs in the family of a milkman, gross contamination may occur in various ways, as by high degree of contamination of water supply, contact of udders with faeces thrown onto manure heaps, infection of milk by the unwashed hands of attendants on patients, etc. Oysters, clams, etc., are often purposely grown near outlets of sewers and, hence, if eaten raw, may transmit typhoid.

Ice, though undoubtedly a means of conveying typhoid, since the bacilli are not immediately killed by freezing, is not an important means, for even a few days' freezing reduces the bacilli almost as much as sand filtration of water. In the course of four or five weeks, especially if alternate freezing and thawing have occured, very few bacilli are left alive, even if the original contamination has been excessive. Thus a very efficient and oeconomic means of preventing typhoid infection through ice, is the insistance on the use of old ice first.

In the case of patients with any contagious disease, even including tuberculosis and, for the sake of being on the safe side, malignant and other diseases not positively known to be infectious, care should be taken against the conveyance of germs by food remnants, eating utensils, etc., destruction of food remnants by fire being advisable in most cases. Attendants should never eat or drink in the sick room and should wash and disinfect the hands before eating or drinking.

Diphtheria, syphilis, tuberculosis, leprosy and various local septic processes, are liable to be conveyed by public drinking cups and imperfectly washed table utensils.

Various habitual entozoa as the gregarines, monads, cermonas, trichomoas, infusoria, rotifera and cyclops, of not much pathogenic importance, are commonly introduced in drinking water and fresh vegetables.

The amoeba—many distinguish A. coli, not markedly pathogenic, from A. dysenteriae, the cause of one form of dysentery—coccidium oviforme, balantidium coli and B. minutum, nyctotherus faba and megastoma entericum, are supposed to be introduced mainly from contaminated water and aquatic plants.

Certain trematodes are found as habitual parasites of wild fowl and are occasionally eaten as delicacies, being popularly supposed to be part of the fowl. Many of the rarer entozoa and those which penetrate to the deeper tissues, have a more or less complicated life cycle, either of the individual or of series of generations. In such instances, one stage of existence is liable to be "free living," in water or upon aquatic plants, so that introduction with food and drink is possible.

With this exception, and that of the cestodes (tape worms) and the trichina of the nematodes, the entozoa are not usually introduced by means of food and drink, except by purely accidental infection. The ascarides and oxyuris, trichocephalus, etc., are essentially what may be termed cheirophoric, that is to say, they are introduced by unclean hands. In the tropics, ova are frequently found beneath the finger nails. Children are especially liable to infection with this group of parasites on account of their close association with domestic animals, lack of aesthetic conceptions, and their proneness to live as close as possible to the floor or ground. Fresh vegetables and surface water are, however, very liable to be contaminated with ova from manure, including human excrement.

In certain of the cestodes, we have a distinct alternation of generations, the adult being an intestinal parasite of one animal, the ova accidentally swallowed by another, developing into a larval stage encysted in muscle and other deep tissues. Being eaten in the flesh, the larvae develop into adult worms in the intestine of the consuming host. While the same individual animal or species, may harbor the same worm in both adult and larval stages, at the same or different times, there is, in certain cases, a quite distinct succession of hosts of different species, for the respective stages of life of the parasite.

Taenia solium occurs in the larval or cysticercal stage in measly pork and when eaten by man, develops the corresponding tape worm. An exactly analogous process occurs for taenia saginata of beef. The corresponding cysticercal stages in man are rare.

Taenia nana occurs only in the adult form in man, the intermediary host being supposed to be an insect or snail, but it has not been connected with the edible snail, or with any other food stuff.

Taenia elliptica or cucumerina is more common in the dog and cat than in man; it is usually harmless, does not—unless very rarely—infest man or the domestic animals in the cysticercal stage and is not connected with diet. Its intermediary host is supposed to be a louse or flea.

Taenia ecchinococcus occurs in the adult form in the dog's intestine, infecting man and other animals in the cysticercal stage. Its transfer is, obviously, not connected with diet unless adventitiously.

Bothriocephalus latus, cordatus and crispus, have their larval stage in fish and are not yet known in this country except by direct importation from the Baltic, Swiss lakes and other regions of north-western Europe. Their transfer to man, in the adult stage of intestinal parasites is exactly analogous to that of T. solium and T. saginata.

Bothriocephalus liguloides occurs in man only in the larval stage.

Trichina spiralis, though not manifesting the alternate stages of the cestodes, is introduced in the same way as the taenia solium, by the ingestion of infected pork.

Anchylostomum or uncinaria duodenale (-is) and americanum (-a) occur in earth-workers and are endemic in certain localities, mainly of a sandy soil. They are often ascribed, especially in the anaemic cases of the southern America "crackers," to clay eating and doubtless are also introduced accidentally by food. The larvae, however, have been proved to pass through the unbroken skin.

Tetanus, anthrax, equinia and malignant oedema, though usually introduced through large or minute wounds of the skin and upper mucous membranes, may occur through alimentary infection of a more or less accidental character. Intestinal anthrax is well known clinically in this form. Whether actual lesion of the alimentary mucous membrane is necessary, is not known. Tetanus is pretty positively shown to correspond in distribution to that of the horse, the bacilli being almost invariably present in the intestine of the horse and in all soil upon which horse manure is deposited. Thus, for civilized man, potential tetanus infection is ubiquitous and may be transmitted by a variety of ways but, fortunately, the germs do not cause trouble unless introduced in such a way as to grow anaerobically.

Actinomycosis—two varieties of the fungus are recognized by many authorities—is due to a parasite of cereal plants

and may develop, especially if a carious tooth or other lesion of the mouth or throat affords a portal of entry, from chewing wheat, or the habit of holding grass or straw in the mouth, or may be disseminated by dust from grain.

Bacillus aerogenes capsulatus infection is, by some, attributed to introduction of the germs in food.

Foot and mouth diseases may be transmitted by milk, especially to children, otherwise, the only infection likely to be transmitted by foods, except in an entirely adventitious and occasional way, is tuberculosis. The bacillus tuberculosis seems to have evolved from the hay bacillus, as a pathogenic parasite of cattle and to have been modified into a fairly distinct variety for human beings. According to the hygienic conditions under which cattle live, the incidence of bovine tuberculosis varies from practically nothing up to nearly 100% for certain small herds subjected to prolonged opportunities for infection from fomites and direct association.

Sheep and goats are nearly immune to tuberculosis and while horses and swine may be infected, bovine animals and particularly domestic cattle are the only important source of infection to man.

While tubercular diseases are described for birds and even cold blooded animals, these seem to have no immediate relation to tuberculosis as the term is ordinarily, specifically, employed and not to be transmissible to man.

Koch and some of his adherents have claimed that the difference between the human and the bovine tubercle bacillus is so well established that mutual infection is impossible. This claim has, however, been disproved by the most convincing experiments and clinical observations, bearing upon the transmissibility in both directions. However, it must be admitted that the two strains of tubercle bacilli have become pretty distinct and that mutual infection is not frequent. There is very plausible evidence that ordinary consumption is due to the human variety, while glandular and osseous tuberculous is mainly or entirely due to the bovine tubercle bacillus. If this is the case, the majority of cases of tuberculosis in human beings are mainly of respiratory

or traumatic implantation, while mesenteric, osseous, and miliary and allied forms are mainly ingestive and due to tuberculous meat or milk.

Tuberculosis of food origin is, therefore, more common in infants but some authorities claim—apparently without good grounds,—that the most frequent portal of entry for all tuberculosis is the alimentary tract, especially the tonsils and intestinal lymph tissue and that the disease may remain latent for long periods, even of many years.

Disinfection of Food and Drink.

The animal parasites are destroyed by moderate degrees of heat, 60° C. or even less. Drying, salting, smoking, etc., cannot be relied upon to kill the larval parasites of meat and they may survive rare cooking. The comparative harmlessness of the beef tapeworm makes it not imperative to cook beef thoroughly, although the practice of serving raw scraped beef and very rare steak and roast beef to invalids is contraindicated by the possible danger of tuberculosis. On account of the frequency of trichinosis, rather than of measles, (cysticercal stage of taenia solium), pork should always be thoroughly cooked.

Very brief exposure of food stuffs to heat kills the great majority of vegetable germs and exposure of tuberculous meats and milk to a temperature of 100° C. or even a little less, kills most of the bacilli in a few minutes, though some of the bacilli with spores will survive. The contraindications to sterilization and even Pasteurization of milk and the choice between these methods, will be discussed more fully under the consideration of infant feeding.

Infants and young children are particularly prone to tuberculous infection from foods, or perhaps it would be more correct to state that the more susceptible individuals are infected early in life by reason of their greater exposure to possible sources of infection, largely in milk, of which adults drink comparatively little. On the whole, the best prophylactic measure is the inspection and destruction of tuberculous cattle and, fortunately, the milk

is not usually contaminated with bacilli early in the disease, when its detection would be difficult.

For oeconomic reasons which are not imperative in America the sale of previously thoroughly cooked tuberculous meat is allowed in certain European countries and while probably toxins exist in the meat in small quantities, no practical danger seems to exist from the use of such meat and it is even possible that some degree of immunity is conferred by it.

Tetanus bacilli are among the most resistant germs known and they can be eliminated with certainty only by subjection to a boiling temperature for a period of nearly an hour. While infection with tetanus by ingestion is rare, it does occur. Moreover gelatin is frequently used as a haemostatic by injection, so that thorough boiling is necessary to insure against this disease. Mucilaginous vegetable substitutes for gelatin may be used in diet, but their nutritive value is doubtful.

Chemic destruction of parasites in food stuffs is not feasible although the customary and allowable methods of preventing the development of bacteria of decomposition diminish disease germs and grosser parasites, to some degree.

The prevention of infection by water may be summed up as follows: 1. Secure a supply free from drainage from cess pools, sewers, etc. This is practicable on a large scale only by a considerable extension of the powers of government. For small supplies, slow filtration through even a few yards of sandy soil, into a well, will remove even gross contamination with typhoid bacilli but if there is anything approaching a subterranean stream, as over a bed of rock or through a seam of rock or coarse gravel, infectious matter may be carried a long distance. There is no rule as to the distance or time required for spontaneous purification of running water. In a large lake, with ample opportunities for sedimentation, action of saprophytes, oxidation, etc., and with no appreciable current, the diffusion of infectious matter will not extend over more than a few miles.

2. Municipalities and institutions, having a relatively clear but infected water supply, can render it practically innocuous by slow sand filtration.

3. Large water supplies containing much clay are best treated by precipitation and so-called mechanic filtration.

4. Domestic and analogous disinfection of water is best effected by boiling.

5. For soldiers and travelers, when portable apparatus for boiling is not available, water may be quite certainly disinfected by standing for a few hours in a copper vessel or in a glass vessel to which hydrochloric acid is added in the proportion of 1:500. The acid may be neutralized before drinking, by adding a little sodium bicarbonate.

Adventitious Poisoning by Food and Drink.

Aside from the inherent ingredients of food and drink, which are discussed in Chapter XV, and substances developing through the action of bacteria upon organic matter, toxic substances may occur adventitiously.

According to local geologic conditions, various mineral poisons may occur in water or even in plants and hence, indirectly, in the flesh of animals. Poisoning of this kind is nearly limited to lead, arsenic, antimony, copper, tin, zinc and certain salts, as nitre. The presence of enough of these poisons to contaminate water and plants to any physiologically appreciable degree, is, on the whole, rare and confined within narrow geographic bounds. In the aggregate, it is not so important as the deleterious action of water highly charged with lime or alkali.

Poisoning from containers is not so frequent as formerly. Water running through lead pipes may produce chronic lead poisoning. Hard water soon deposits a coating which prevents the solution of lead to any appreciable degree. The softer the water, the more carbon dioxid it contains and the higher its temperature, the more likelihood is there of lead poisoning from pipes. In any circumstance conducing to lead poisoning, sulphates or sulphuric acid lemonade—with due attention to the teeth—should be employed as a routine prophylactic.

Pewter and brass dishes are very likely to produce mineral poisoning, especially if used to contain acid foods and beverages

or those in which acidity may be produced by fermentation. It is, at present, rare. Lead poisoning may also occur from the use of cheap "tin" ware or solder; so also may other minerals be present. Provided that pure tin and solder free from lead, arsenic, etc., is used and that the contents of cans are not acid, there is very little danger from the use of canned goods. Zinc and tin poisoning are, however, occasionally reported but the rarity of such reports and the marked severity of the symptoms in certain groups of cases, suggest an error in diagnosis.

Preservatives, such as salicylic and boric acid, hyposulphites, formic aldehyde, etc., rarely produce acute poisoning but their prolonged use produces fibrosis of the blood vessels and viscera, especially the kidneys.

Adulteration and sophistication are of widely different forms: 1. The more or less complete substitution of a perfectly harmless and equally or nearly equally valuable nutrient, as glucose for cane sugar; fat for butter in oleomargarine; cereal meals, etc., for chocolate or coffee; acetic and citric acid for vinegar and the natural juice of lemon, cotton-seed or peanut oil for olive oil etc.; or the analogous substitution of a cheaper for a more expensive grade of food stuff, of vanillin or other active principles prepared synthetically or from cheaper natural sources, instead of from the regular source; or the substitution of a wine, tobacco etc., from a miscellaneous source, for a brand supposed to come from a distinct locality. Such frauds are of no hygienic importance.

2. The use of fillers of various kinds, but not distinctly toxic or injurious; as lard in cheese, corn starch in ice cream, terra alba, kaolin etc., in candy, paraffin in gum, glucose in honey, flour in spices etc.

3. The use of various pigments. In so far as these are harmless, there is no particular objection to their use. Butter is frequently colored with carrot or anatto; peas, beans etc. with chlorophyl, which is even cheaper than copper, although the latter, in the small quantities used, is not especially dangerous. Synthetic aniline dyes are used to color candy frosting etc. and,

for the most part, do no harm. Chrome yellow is a dangerous pigment for whose use there is no excuse.

Under present conditions, the adulteration of food stuffs is not very prevalent, except in physiologically innocent forms. Sugar is almost 100% pure, a slight trace of blue pigment being added to kill the natural yellow tinge, to which latter there is no sound objection. Even powdered sugar is usually free from starch. So long as maple syrup and honey taste like the natural product and are rich in sugar and free from toxic ingredients, it is of no practical disadvantage that most of the saccharose of the former is derived from sugar cane or beets, for the sugar is identical with that of the maple; nor that the honey comb is pressed out of paraffine nor that the bee, instead of extracting the sugar from flowers, carries it from a convenient pan of glucose nor even that a man instead of a bee fills the comb.

In many cases, it is difficult to decide how far a name of a food should be used literally. If butter crackers really contained butter they would not be so well flavored; no one expects a marsh mallow drop to be made of marsh mallows; the average purchaser would feel that he had been cheated if he was given genuine iceland moss gum, not flavored with anise, instead of a plain sugar candy with this flavor. Paraffine answers the purpose of a chewing gum quite as well as any vegetable gum and, in so elaborate preparations as confections, any pigment, flavor, or base which is harmless and which does not detract from the sapid qualities, is permissible. It is easy for a manufacturer or dealer to apply the same line of argument to various other articles of diet. However, the following points should be and, for the most part, are insisted on by health authorities, with fairly efficient enforcement:

1. Any poisonous substance or any which may reasonably be considered to be probably poisonous, should be interdicted;

2. The trade name and label should indicate the true nature and source of an article so that if a cheaper substitute—although of equal practical value—is offered, it should be purchasable at a cheaper price. For instance, there is no reason why pea nut or cotton seed oil should not be used in place of olive oil

and, equally, no reason, why the dealer should be paid the price of olive oil. In some instances, it is very easy, in others very difficult to determine how far a trade-name should be construed literally. A Boston cracker need not be made in Boston and a soda cracker made in Boston is not a Boston cracker in the dietetic sense. It is more difficult to decide whether Swiss cheese should mean the imported article, or whether it applies to any cheese in which gas bubbles have formed under the action of the colon bacillus or merely to any fairly tough cheese that is markedly porous.

3. A food stuff that is commonly used as an article of nourishment, should not only be free from harmful ingredients but should contain the ordinary natural or commercial ingredients, in standard amounts and proportions, subject to unpreventable natural or commercial variation.

4. A food stuff—for example, candy—that is not ordinarily used as a source of nourishment and that is avowedly of complex and artificial composition, may contain any ingredient that is not harmful and that does not render it unpalatable or that does not depart too far from the ordinary composition.

CHAPTER XVII.

GENERAL HYGIENE OF EATING.

An individual in health, taking a reasonable amount of exercise, does best to follow his natural appetites with regard to quantity and kind of food, though an intelligent appreciation of physiologic demands and the nature of food stuffs is always of value.

Many persons become morbid from thinking too much of their digestive physiology. Sanitarium life is particularly demoralizing to such persons. Many physicians apply their professional ideas to themselves and their families with the result that they become health cranks. On the other hand, health cranks of all kinds are usually produced by imperfect, unqualified information, carried to an extreme in one direction.

Good alimentary hygiene, like good German grammar, involves a knowledge first of rules, then of exceptions and finally of exceptions to exceptions. For example, an ideally healthy life involves regularity of habits and moderation and avoidance of risks. But neither moral, mental, muscular nor digestive strength can be developed without occasionally testing the strength by irregular and excessive demands and even the incurring of some danger. But, as an exception to the exception, care must be taken not to make irregularity itself a routine, nor to make the strength test with a strain beyond the breaking point, nor to ignore the experience of others and of oneself in the past, in running risks.

Sound sleep requires previous fatigue. So good appetite, even the zest for some particular food requires incipient starvation. Thus, while the anabolic processes are normally nearly constant, so as to supply material for oxidation and repair of waste as needed, occasional periods of moderate shortage do no harm but rather stimulate organic vigor and oeconomy. It is scarcely in analogy

to state that the actual ingestion of food and drink should be intermittent, since there are provisions for reserves.

At the same time, the supply and consumption of nutrients should balance almost exactly for periods of a week and approximately, day by day; excepting as there is an indication to remove an excess or make good a deficit. It is even wise to have the separate meals correspond approximately to the demands for the succeeding periods.

The young infant should spend most of his time in sleep, awakening only to nurse and remaining awake only for the short time needed for exercise. During the second and third years, the child requires about 14 hours sleep, gradually reduced to 12 by the eighth or tenth year and to 10 at the close of adolescence. The arrangement of meals and naps are discussed in the chapter on Dietetics of Infancy.

During active adult life, the amount of sleep depends to some extent upon heredity and bodily vigor but largely on the severity of mental and physical labor. Thus the overworked medical student requires more sleep than most other professional students or than the average college student. For severe mental and manual labor, ten hours' sleep are usually required. Light physical labor, routine clerical work and easy professional occupations require only 7 or 8 hours' sleep. If the work covers long hours, more sleep is required than if several hours are spent in rest. The adult, like the child, who "plays hard," either in the sense of engaging in physical sports, or games requiring close mental application or delicate training of the special senses of muscles (chess, whist, billiards etc.) or a strenuous social life, requires more sleep than the one who is in a state of mental and physical inertia when not working or sleeping.

Persons engaged in heavy manual labor, as on a farm or in a lumber camp, require a hearty breakfast and dinner, preferably served hot and a light supper. For the first two meals, it is even advisable that the food should be rather slow of digestion, since the sense of hunger and weakness, depends largely on the emptiness of the stomach. The supper on the other hand, should be light and easily digested, consisting of bread and milk, or other cereal

food, with milk and eggs, fruit etc., so as not to interfere with sleep by the stimulation of metabolic products and so that no great demand for innervation shall be made on the nervous centers. Even the interruption of sleep by a full bladder and especially by one filled with urine rich in waste products and of high acidity, on account of a heavy evening meal, must be considered.

On the other hand, skilled labor, not involving great physical or mental fatigue and lasting only eight or nine hours, does not usually allow or demand a hearty, warm, noon dinner, although both breakfast and luncheon should be richer in carbohydrate and fat than those of a professional or business man. Whether the evening meal is called supper or dinner, it should be essentially a dinner served hot, eaten leisurely, and it should be relatively more hearty than for the strictly manual laborer.

Business and professional men, rising later in the morning and going to bed later in the evening, should eat a light breakfast of 500—700 calories, a slightly heartier luncheon and should take the principal meal at the close of the day's work, allowing four or five hours for its digestion, before retiring.

For persons of leisure, keeping late hours at night, the most convenient arrangement is a fairly hearty combination of breakfast and luncheon at ten or eleven, a dinner at five, and a light supper, not too unwholesome and with very little stimulating beverages, either xanthin or alcohol-containing, at eleven or twelve in the evening.

Business and professional men whose work is quite equally divided between the morning and afternoon, and whose social life is relatively simple, should, if possible, take the leisure for a warm noon meal, the dinner and supper or luncheon and dinner, being nearly equal in amount and variety.

There is no physiologic absurdity in dividing the day's sleep and work into two equal portions, as is the custom in many barbarous countries, and in certain vocations, as on the sea. In such cases, the meals would naturally arrange themselves into two sets of breakfasts and luncheons, or suppers, with no single hearty meal.

In case of loss of sleep, it is better to make it up as soon as possible, skipping breakfast, for example, rather than to shorten the sleep for the sake of adhering to a regular schedule.

Night workers usually go to bed as soon as possible after finishing their day's work and take their recreation before it begins. Manual laborers require the same arrangement of meals, at opposite hours, as day laborers. Business and professional night workers usually begin and close their work at relatively earlier hours in the evening and morning than corresponding day workers in the morning and afternoon, respectively, and they have, therefore, correspondingly more time before luncheon, after completing their sleep, than day workers have before breakfast. Hence, they can very well use the ordinary luncheon and dinner and take a light supper toward the close of the night's work.

In ordinary climates, free from miasmatic infections—which probably mean diseases borne largely by nocturnal insects—the prejudice against night air is mainly imaginary; indeed, it is claimed by some that direct sunlight is deleterious to all organisms and that its hygienic value is limited entirely to its germicide action. Thus, if sleep and food are regularly taken, there is no marked hygienic disadvantage about night work.

A full stomach is commonly regarded as a protection against prolonged physical and mental fatigue, exposure to cold, damp, and infection. This is true in the sense that the increased demand for nutriment should be met by hearty meals, even at unusual hours; but it is a dangerous fallacy, if construed as an indication for overeating or for eating at too short intervals. Coffee, tea and chocolate have their greatest value and alcoholic beverages their greatest danger, in meeting such emergencies. In particular, alcohol should not be used before going out into the cold.

While regularity in meals is advantageous, it is never necessary to make oneself a slave to the clock by insisting on punctuality to the minute and, if for any reason, any one meal is antici-ticipated or postponed, it is best to change the others correspondingly, so as to leave the usual time, ordinarily 5—6 hours, as an interval.

It is not wise to eat heartily simply because it is meal time in the absence of appetite but it is not advisable for a person in ordinary health to skip a meal entirely, unless there is some derangement of digestion. A fair compromise is to eat a few crackers or a slice of bread and butter, or some similar portion of a meal.

The tendency to bring all the meals of the day into the period between 9 and 6 leaves scant time for physiologic rest.

Variety in diet is an important factor in stimulating appetite and digestive secretion. Variety, however, does not necessitate the use of improper, imported or expensive food stuffs. A fair degree of uniformity of diet in the organic nutrients, and even in the groups of food stuffs such as breads, cereals, meats etc. should be followed, but different kinds of bread, crackers, meats, fruits etc. should be freely used and different methods of cooking and flavoring should be employed. Cereals, eggs and milk and cream can easily be changed from substantial courses to dessert, by changes in flavoring, the addition of fruit, jelly etc. Benefit ascribed to change of climate and scene is often really due to a change of cook and of cooking. Often perfectly wholesome and even expensive and well cooked food, fails to fulfill its function, because of lack of ingenuity of the cook in affording variety and pleasing flavor.

While the physician need not be a cook, he should understand the general methods of preparing foods, and should know the ingredients of compound dishes, just as thoroughly as he knows the meaning of Galenical terms and the ingredients of tinctures, compound powders, pills etc. If he is ignorant of what he eats himself and has no conception of what enters into a doughnut, salad, dressing etc., he can not intelligently direct the diet of patients. He should study the cook book exactly as he should the Pharmacopoeia or a work dealing with pharmacognosy or materia medica, not that he need master the art either of cooking or pharmacy, but that he may have an intelligent, general conception of both subjects.

During digestion, especially for the first two or three hours after a hearty meal, the alimentary tract requires both a liberal blood supply and an abundant innervation. The former is not

usually compatible with full functional activity either of the brain or the muscles, nor the latter with deep sleep. However, the system usually becomes accustomed to fairly active physical exertion and even not too engrossing mental activity, after a moderate meal. Thus, it is well to eat two or three hours before any exceptionally difficult mental or physical exertion and to rest or even take a nap after a hearty meal, but not to eat heartily just before bed time. Sleepiness is, however, often combatted by taking a light lunch just before going to bed. Any apparent inconsistency in these statements is reconciled by appreciating the fact that a balance of blood supply and innervation is what is wanted, not an excess in either direction.

The glutton who does not suffer immediately from his excesses should be viewed in the same unfavorable light as the alcoholic "tank" and an attack of indigestion, diarrhoea or appendicitis due to overeating should be considered as inexcusable as drunkenness.

For strictly hygienic reasons, a meal should be a cheerful occasion, especially for children, and there is no objection to making it a social function, on occasion. Meals should be eaten leisurely, to allow ample time for mastication and insalivation and for deglutition without provoking oesophageal paresis or spasm from undue haste. On the other hand, the meal should not usually be unduly protracted and, even if it is a means of entertainment, palatability should not entirely supplant digestibility and nutritive value of food.

Unless there is a deliberate attempt to cloy the appetite, as in obesity, the stomach should not be filled with water, soup etc. at the beginning of a meal. A moderate amount of liquid, say 250—500 c.c., may, however, usually be taken by persons in health at each meal and, if there is a tendency to accumulation of mucus or lack of sufficient secretion, digestion occurs more rapidly if liquid is used. As an approximate rule, the stomach contents, one hour after a meal, should consist of 50% of water that can be removed by filtration.

With the same general exception as before, plainer foods should be eaten first, "good things" last. An elaborate dinner

usually consists of a double meal, the first dessert being represented by compotes, sherbet etc. Such meals are usually too elaborate and often represent an entire day's ration. There is no reason for using fruit first at breakfast, but the usual arrangement should be followed as for other meals.

While, for persons in health, there is usually no objection to the occasional use of sweet drinks, candy, fruit and nuts between meals they should not be used in large quantity nor so soon before a regular meal as to spoil the appetite.

It should be remembered that "good things" are, on the whole, richer in caloric value than plain foods. An ice cream soda or sundae (sondhi) represents 200—400 calories, a half pound of candy about 900, a half pint of unshelled peanuts, about 900. The last also furnishes almost 20 grams, a third of the day's ration, of proteid. Even fruit contains a considerable amount of sugar. Most persons, even physicians, fail to realize that an allowance should be made for such indulgence, in the ration for the regular meals.

The average individual spends approximately equal amounts for raw material for food and for clothing prepared for use, each aggregating about 1/10 of the total per capita income for persons in moderate circumstances. The average individual of moderate income, reckons the durability and serviceability of clothing pretty closely, in relation to its price but absolutely ignores the similar relation of gross price and caloric or proteid value of food. 20 cents a day a person, is a liberal allowance for food (unprepared) even sufficient to provide for considerable variety and palatability. Anything over this figure is purely a luxury. The cost per pound of an article of food has no necessary relation to its cost per unit of food value. Many of the cheaper cuts of meat are dearer than the more costly cuts, by reason of oeconomic waste and, even if the caloric value is high, it is so usually on account of fat which is trimmed off by most persons and which is not available for food beyond a total of about 150 grams a day. The average family is said to spend just about 1/10 of the total expenditure for food, for butter and the average individual uses a pound a week, representing nearly or quite a quarter of his total caloric needs, more

fat than is needed altogether and nearly half of the maximum amount that can be ingested without serious physiologic waste and disturbance of digestion.

Considering both financial and physiologic oeconomy, the most oeconomic dietary consists of sugar, about 100 grams, cereal flours and meals in bulk or large packages, about 200 grams, small amounts of lean meat and milk, and reasonable quantities of fresh vegetables and fruits. Such a dietary, perfectly plain but wholesome and adequate, can be obtained on a per capita allowance of 10 cents a day for groups of 10 or more persons.

Various exclusive dietaries have been suggested for different conditions: vegetarianism, meat diet for obesity, milk diet for many fevers and metabolic states, eggs alone, grape cures, oatmeal, etc. German authorities especially, have laid down explicit and arbitrary diets for gastric ulcer, as a precursor of faecal tests, etc. These are not described in the present work as many are entirely irrational while all require the personal equation of the patient. It is just as irrational to treat a given disease with one food stuff as with one drug and to lay down an arbitrary schedule of quantities of food as of doses of drugs.

Relation of Medication to Meals.

Alkalies should ordinarily be given before meals, especially if given to promote the secretion of hydrochloric acid (although this action is not reliable). Half an hour or so should be allowed for their passage into the intestines. If used to reduce gastric acidity, they should be given one hour or more after meals, and often in repeated doses. For this purpose, alkaline hydrates and oxids should usually be preferred to carbonates. A common error consits in regarding neutral salts of alkaline metals, as alkalies.

Acids should be given after meals. Hydrochloric or other acids used to supplement deficient hydrochloric acidity should seldom be given less than an hour after meals, in order to let the stomach do what it can in this direction, and they are often needed in several doses at intervals of half to one hour. They should not

be given after the stomach has emptied itself. The attempt to reduce hyperchlorhydria by administering an acid before meals usually fails.

Bitters and other remedies used as spurs to appetite and gastric secretion should be given shortly before meals.

Drugs which have a local irritant action, unless for some reason, this is desired, should be given during or after a meal, in order to secure dilution and admixture with the stomach contents.

Drugs intended to act locally on the stomach, as bismuth, emulsions of bismuth etc., with purpetrol, hydrogen peroxide and other detergents, should be given three or four hours after a meal and the interval between meals should be lengthened as much as possible to allow time for their action.

Nauseating drugs should be given immediately after a meal, if their local effect can be prevented by admixture of stomach contents; otherwise, they should be given as the last group.

Remedies intended to act mainly on or in the intestine, should be given about three hours after a meal and in capsule, if they are decomposed by the gastric juice. Most gelatin capsules do not dissolve within an hour but salol or keratin coatings may be employed for pancreatin etc. Many substances, such as salol, salacetol, iodipin etc., are not decomposed to any degree in the stomach and hence may be given immediately after a meal.

Saline cathartics act more energetically if taken half an hour or so before breakfast or other meals and may fail if given at night when the patient is soon to be quiet in bed: Other cathartics, intended to act from a single administration, are best given at bedtime. Laxatives used regularly, in small dose, as cascara, are best given with meals, whether before or after, being a matter of indifference, unless they cloy the appetite if given before or disturb the stomach if given after.

When there is no particular indication as to time with reference to meals, it is usually more convenient for the patient to take medicines at meal times rather than several hours afterward. The strength of patients may often be conserved by following this rule and greater regularity is insured in ambulant patients.

Corrosive medicines of all kinds, such as acids, mineral salts of iron etc., should be given sufficiently diluted, and should be drunk through a tube or the tongue should be used as a trough, and the mouth should be immediately rinsed, in either case, preferably with a dilute alkaline solution, as of soda and borax.

Chocolate may be used to disguise the taste of quinine and other bitter drugs. Cod liver and castor oils may be given in whisky, or milk, or after salt has been placed on the tongue. Jam, apple sauce etc., may be used to disguise the taste of some medicines, or they may be placed between pieces of bread. Iodides, salicylates etc., may often be given in milk. Iron salts should usually be given in syrups—never in mucilages—both to disguise the taste and to prevent corrosion.

The food and digestive juices contain various substances more or less incompatible with certain medicines; for example, starch with iodine, hydrochloric acid with calomel, hydrochloric acid, proteids and mucin with silver salts, tannin with alkaloids, iron and various other substances; gummy substances with iron. To what degree these incompatibilities are of consequence or how far they can be avoided, must be considered in each instance.

CHAPTER XVIII.

DIET LISTS.

U. S. Army Ration.

		Proteid Grams	Fat Grams	Carbohydrates	Calories
Fresh beef.........	20 ounces	83.35	89.5	...	1180
or Mutton......	20 ounces	92.4	125.8	..	1440
or Pork.. ...	12 ounces	55.08	225.08	..	2187
or Bacon......	12 ounces	31.28	210.12	..	2085
or Salt beef......	22 ounces	88.6	142.3		1534
or Salt cod....	14 ounces	63.52	1.59	..	276
or Fresh fish.. ...	18 ounces	40.8	1.02	....	155
Flour..	18 ounces	55.08	5.6	380.46	1850
or Bread.	18 ounces	48.45	6.12	269.25	1355
or Hard bread..	16 ounces	65.7	5.9	330.5	1712
or Corn meal....	20 ounces	50.4	12.4	425.8	1986
Beans...........	.2 2/5 oz.	15.16	1.22	40.18	240
or Rice.......	..1 3/5 oz.	3.5	.18	35.55	163
or Peas........	...2 2/5 oz.	16.38	.75	41.8	246
or Hominy...	..1 3/5 oz.	3.69	.27	35.5	172
Potatoes..	16 ounces	9.5	45	81.7	380
or with 1/5 onions	16 ounces	8.6	.72	73.09	340
or with 3/10 canned Tomatoes...	16 ounces	8.17	.54	65.8	297
Dried fruit (average composition)......	2 ounces	1.18	1.02	33.8	147
Sugar.....	.2 2/5 oz.	..	.....	64.6	264
or Molasses.......	.16/25 gill	...	....	41.25	198
or Cane syrup.....	.16/25 gill	...	...	41.36	198

It will be noted that the divisions of the above ration afford a range of choice of nearly equivalent food values, excepting for the meat ration, in which very great variations occur. Up to the meat ration, we have very nearly the standard Chittenden diet for a person at light exercise: 60—80 grams of proteid, 8—115 grams of fat and about 500 of carbohydrate, the caloric value being about 2500. By proper choice of the meat ration, according to exposure and fatigue, the diet can be regulated to meet the demands of the body although the criticism seems warranted that the total ration would then be rather liberal in proteid and excessive in fat and that it would be both cheaper and more hygienic to provide a more fixed meat ration and to allow for greater variation among the cereals, legumes and sugars.

Munson suggests four tropical rations, each containing 3 ounces of dried fruit, 3 of sugar, 18—20 of bread or flour, 16 of potatoes or smaller quantities of other vegetables, and from 6 ounces of bacon to 14 of fresh fish. These give a range of 10—114 for fat, 517—630 for carbohydrates and 104—123 for proteids and have a calory range of 2950—3825.

Diet List Appropriate For Invalids.

Broths.

Bouillon (Beef, lamb or chicken).
Bouillon and Barley, Sago, Rice.
Bouillon and Oat-meal.
Bouillon and Tapioca.
Beef Consomme.
Chicken Consomme.
Chicken and Clam Juice.
Veal plain or with rice.
Veal, Barley, Sago, Tapioca.
Calf's Foot.
Oyster Juice.
Oyster Stew.
Beef Juice.
Mutton Juice.

Beverages.

Milk, plain.
Milk, Peptonized.
Milk, Sterilized.
Milk, Pasteurized.
Cream, plain.
Cream, Sterilized.
Cream, Pasteurized.
Milk Punch.
Sago Milk.
Cocoa.

Beverages—*Continued.*

Chocolate.
Rice Water.
Apple Water.
Tamarind Whey.
Barley Water.
Egg Nogg.
Wine Whey.
Lemonade.
Lemonade, Flaxseed.
Lemonade, Irish Moss.
Orangeade.
Pineapple Juice.
Strawberry Juice.
Cherry Brandy.
Blackberry Brandy.

Purees and Bisques.

Chicken.
Beef.
Mutton.
Oyster.
Clam.
Tomato.
Pea.
Rice.
Macaroni.
Tapioca.

Gruels.

Oat-meal.
Farina.
Cerealine.
Cream of Wheat.
Cream of Rice.
Cream of Barley.
Indian Meal, Yellow.
Indian Meal, White.
Wheat Flakes.
Flour.
Cracker.
Arrow Root.
Boiled flour.
Baked flour.
Oat-meal Caudle.
Gruels Peptonized.

Jellies.

Brandy, Calf's Foot.
Sherry, Calf's Foot.
Rum, Calf's Foot.
Port, Calf's Foot.
Champagne, Calf's Foot.
Lemon, Calf's Foot.
Orange, Calf's Foot.
Beef.
Beef Aspic.
Mutton.
Chicken.
Chicken Aspic.
Chicken and clam.
Veal.
Tomato.
Clam.
Coffee.
Milk.
Prune.
Cranberry.
Guava.

Bread and Biscuit.

White.
Whole Wheat.
Gluten.
Rye.
Graham.
Pulled.
Plasmon.
Bread Crumbs.
Raised Biscuits.
Tea Biscuits.
Parker House Rolls.
Corn Muffins.
Dry Toast.
Milk Toast.

Puddings and Desserts.

Ice Cream, all flavors.
Ice Cream with Plasmon.
Ice Cream with Somatose.
Sherbets, all flavors.
Bavarian Cream.
Tapioca, Cream.
Egg Cream.
Chocolate Cream.
Boiled Custard.
Orange Custard.
Orange Snow.
Cocoanut Custard.
Chocolate Custard.
Caramel Custard.
Baked Custard.
Rennet Custard.
Rice.
Bread.
Cottage.
Minute.
Graham.
Indian.
Feather.
Tapioca.
Tapioca Apple.
Apple Trifle.
Lemon Snow.
Prunes Stewed.
Prune Jam.
Prune Whip.
Farina Blanc-Mange.
Sea Moss Blanc-Mange.
Corn Starch Blanc-Mange.
Chocolate Blanc-Mange.
Fresh Fruit Stewed.
Dried Fruit Stewed.
Honey.
Baked Apples.

Sandwiches.

Scraped Beef.
Chopped Chicken.
Bone Marrow.
Celery.
Egg.
Watercress.
Lettuce.
Fig.
Orange Marmalade.
Cream Cheese.
Bread and Butter.

Miscellaneous.

Salisbury Steak.
Tenderloin.
Roast Chicken.
Broiled Chicken.
Chicken Breast, creamed.
Sweetbreads.
Chops (2).
Fish Balls.
Escalloped Fish.
Escalloped Oysters.
Stewed Potatoes.
Baked Potatoes.
Apple Sauces.
Stewed Rhubarb.
Creamed Celery.
Creamed Spinach.
Cereals, boiled.
Butter.
Eggs.

Mrs. E. H. Richards has suggested the following for an adult not engaged in active exercise:

	Gm.	Oz.	Proteid	Fat	Carbo-hydrate
Bread	453.6	16	31.75	2.26	257.28
Meat	226.8	8	34.02	11.34	....
Oysters	226.8	8	12.52	2.04	....
Cocoa	28.3	1	6.60	7.50	9.60
Milk	113.4	4	3.63	4.42	4.88
Broth	453.6	16	18.14	18.14	90.72
Sugar	28.3	1	....	...	27.36
Butter	14.17	½	.14	12.27	.....
Total nutriment			106.80	57.97	389.84

The "carbohydrate" in broth must mean gelatin. If one were to criticize this ration, it would be mainly from the standpoint of the palate. The amount of milk allowed for cocoa is very small, only half of an ordinary cupful for the entire day. Much better cocoa is made of entire milk plus the powdered chocolate made into paste. The allowance of oysters is rather large, except for a single day's ration not to be repeated. The bread is rather high and most persons would prefer to replace part of it with

potatoes when a larger amount of meat would be needed. The sugar is very low, not much over a quarter of that taken by choice.

Examples of Low Proteid Ration, Taken from Dr. Russell H. Chittenden's Experiments With Soldiers and Students.

Actual consumption of food by soldier for one day.

Breakfast—

Fried Indian Meal	100 grams	
Syrup	50	
Coffee, 1 cup	350	(367 c.c., nearly 2 ordinary cups.)
Bread	50	(1 large slice.)
Butter	15	(ordinary hotel pat or ball.)

Dinner—

Boiled Macaroni	250
Stewed Tomatoes	250
Bread	75
Coffee	350

Supper—

Potato Chips	100
Fried Bacon	25
Bread	75
Jam	75
Tea	350

Total nitrogen in above ration, 7,793 grams, corresponding to 48.71 grams of proteid (really slightly less as all of the nitrogen is not in proteid combination). Total calories 2404.

Actual consumption of food by soldier for one day.

Breakfast—

Boiled Hominy	150 grams
Milk	125
Sugar	30
Butter	10
Bread	30
Coffee	350

Dinner—

Split Pea Soup.. ...200		
Bread...... 75		
Mashed Potatoes.....100	(equivalent to 1 large potato.)	
Pickles..... 30		
Coffee...... 350		
Pie.. 120	(1 good sized piece.)	

Supper—

Suet Puddings.. ..150	
Apple Sauce.. .. .125	
Crackers..... ... 25	(5 small butter crackers or 1 large soda cracker.)
Tea...... ... .350 c.c.	

Total nitrogen in above ration, 7.412 grams, corresponding to 46.325 grams of proteid. Total calories 2000. (Rather a low ration for a fairly active adult.)

Actual consumption of food by soldier for one day.

Breakfast—

Boiled Rice.... ...150 grams	
Milk... 125	(150 c.c.)
Sugar.. 30	(about 5 lumps or 6 teaspoonfulls.)
Butter.. 10	(small pat.)
Bread........ ... 30	
Coffee......... 350	

Dinner—

Hamburg Steak with plenty of bread, fat and onions chopped together...... 150	
Boiled Potatoes......200	(2 large potatoes.)
Apple Sauce.... ...200	
Bread...... 75	
Coffee...... .... .350 c.c.	

Supper—

Fried Rice	100
Syrup	50
Tea	350
Bread	50
Butter	15

Total nitrogen in above ration 9.992 grams, corresponding to 62.45 grams of proteid. Total calories 2133.

Actual consumption of food by soldier for one day.

Breakfast—

Wheat Griddle Cakes	200 grams	
Syrup	50	
Coffee	350 c.c.	

Dinner—

Cod Fish Balls	158	(4 parts potato, 1 part fish fried in pork fat.)
Stewed Tomatoes	200	
Bread	75	
Coffee	350 c.c.	
Apple Pie	95	

Supper—

Apple Fritters	200	
Stewed Prunes	125	(12 large prunes.)
Bread	50	
Butter	15	
Tea	350 c.c.	

Total nitrogen in above ration, 8.56, corresponding to 53.5 grams of proteid. Total calories 2030.

Actual consumption of food by soldier for one day.

Breakfast—

Soft Oatmeal	150 grams
Milk	100
Sugar	30
Bread	30
Butter	10
Coffee	350 c.c.

Dinner—

Baked Macaroni with a little cheese	200
Stewed Tomatoes	200
Bread	50
Tapioca Peach Pudding	150
Coffee	350 c.c.

Supper—

French Fried Potatoes	100
Fried Bacon	20
Bread	75
Jam	75
Tea	350 c.c.

Total nitrogen in above ration, 7.282 grams, corresponding to 45.51 grams of proteid. Total calories 1824 (inadequate).

Actual consumption of food by soldier for one day.

Breakfast—

Boiled Indian Meal	125 grams
Milk	125
Sugar	30
Butter	10
Bread	30
Coffee	350 c.c.

Dinner—

Thick Bean Soup	200
Bread	75
Mashed Potato	100
Pickles	25
Coffee	350 c.c.
Custard Pie (fair-sized piece.)	105

Supper—

Crackers	50	(8—10 small butter crackers.)
Butter	15	
Stewed Prunes	125	(12 large prunes.)
Sponge Cake	100	(4 small pieces.)
Tea	350 c.c.	

Total nitrogen in above ration 8.349 grams, corresponding to 52.18 grams of proteid. Total calories 2081. (Rather low.)

Actual consumption of food by soldier for one day.

Breakfast—

Boiled Rice	175 grams
Milk	125
Sugar	25
Baked Potato (1½ large potatoes.)	150
Butter	10
Coffee	350 c.c.

Dinner—

Baked Spaghetti	250
Mashed Potato	250
Bread	75
Boiled Tomatoes	150
Apple Pie (good sized piece.)	112
Coffee	350 c.c.

Supper—

Biscuit	175	(3 large raised biscuit or 6 small.)
Fried Bacon	20	
Fried Sweet Potato	150	
Butter	20	
Tea	350 c.c.	

Total nitrogen in above ration, 10.466 grams, corresponding to 65.42 grams of proteid. Total calories 2670, a full ration for a man at light work.

The above dietaries represent a fairly liberal variety for working men not engaged in too heavy labor. It must be remembered that the soldiers were specially detailed for the experiment but that they were doing certain routine duties and were exercising in the gymnasium, so that the demand for nourishment was practically equal to that for peace service. The men maintained their weight and gained in strength. Thus the general adequacy of the ration, of which the foregoing are fair samples, cannot be questioned. However, it may be questioned whether it is advisable to use so much as a liter of tea and coffee a day Owing to great differences in the percentage composition of tea and coffee and of different samples of each, as well as of the strength of beverages it is impossible to make any exact statements as to what these beverages represent. Still, the use of tea and coffee up to a

total of a liter a day means the ingestion of about 1 gram of nitrogen and while both tea and coffee contain albuminoids, their nutritive value is uncertain. Moreover, their use in this amount introduces $\frac{1}{4}$—$\frac{1}{2}$ gram of caffeine or theine and 1—2 grams of tannin daily. The nitrogen content of a liter of tea and coffee corresponds roughly to that of 30 grams of lean meat or to that of the white of an egg. It can scarcely be disputed that such substitution for tea and coffee would be preferable. 30 grams of lean meat corresponds to a medium sized chop or a small slice of roast beef and adds about 100 calories to the ration.

On the whole, it may be said that the above sample dietaries would be improved by reducing the allowance of tea and coffee to 1 or 2 ordinary cupfuls daily and adding 1 or 2 servings of fresh meat.

For students, a more liberal variety and at a greater expense was allowed by Dr. Chittenden and the arrangement of meals was breakfast, luncheon and dinner. The following is a sample ration, nearly on a vegetarian basis:

Breakfast—

Banana	141 grams	(about 3 medium-sized.)
Bread	60	
Butter	15	
Coffee	150	
Cream	80	
Sugar	31	

Luncheon—

Soup	247	
String Beans	65	
Bread	21	
Butter	30	
Coffee	150	
Sugar	21	
Fried Potato	222	(about $2\frac{1}{2}$ large potatoes.)

Dinner—

Consomme	150
Bread	45
Butter	10
Mashed Potato	150
Spinach	200
Apple Pie	103
Coffee	150
Cream	75
Sugar	28

Total nitrogen in above ration 8.119 grams, corresponding to 50.74 grams of proteid. Total calories 2676.

CHAPTER XIX

CONDENSATION OF ATWATER AND BRYANT'S ANALYSES OF FOOD STUFFS.

Explanation of the Analytic Table.

It should be borne in mind that analysis of organic ingredients of foods is not so exact as that of inorganic substances generally. In Atwater and Bryant's original table, nitrogenous matter is designated "protein", which means nitrogen by Kjehldahl method, multiplied by 6.25. While most of this is proteid, a small, occasionally in vegetables, a large, proportion is in other forms. Throughout most of the tables for meats and other animal foods, the proteid is controlled by subtracting the other ingredients, including water and mineral matters from 100%. The difference between these two estimates of "protein" is usually less than 1% of the total meat and the N $\times$ 6.25 estimate is usually but not always in excess of the estimate by difference. For vegetables, the protein is usually (in such cases as it has been checked) nearly double the true proteid, occasionally more than double.

For vegetables, the term carbohydrate includes both digestible carbohydrate and cellulose not included in the gross waste. The latter usually amounts to at least 1% of the total weight of the edible food-stuff and sometimes to 4 or 5%. So far as possible the author's condensation of Atwater and Bryant's table presents the net percentage of digestible carbohydrate.

Unless stated to the contrary, the percentages of nutrients are based on the par value of the edible food stuff. That is to say, if the waste is estimated at 20% and the proteid at 10%, the latter number means 10% of the remaining 80%. By edible food stuff, after removal of waste, is meant the material as ordinarily prepared for cooking, with removal of bones, skin, entrails, peelings,

cores, pods etc. Thus, the edible food stuff still contains considerable material ordinarily removed by dainty eaters, as fat, gristle etc. of meat and fine skins and other parts of vegetable foods, under crust of pie etc. beside material in certain foods which is physiologic waste.

As a rule, the waste of fat meats, in the list, is less than of lean whereas, in actual consumption, most of the clear fat is trimmed off on the plate.

There have been omitted from the condensed table, a few large cuts of meat, as quarters, not ordinarily purchased by private families, some viands little used, and certain analyses of canned meats, proprietary products etc. which cannot be considered as applying with any certainty to other samples as purchased in the market. Otherwise, the condensation has been mainly in the line of grouping together separate estimates of very lean, lean, medium fat and very fat meats, and of different grades of flours, brands of bread etc., taking the extreme minima and maxima for the whole group. That this is allowable is shown by the fact that the minimum of proteid is not necessarily found in the very lean meats nor the maximum of fat in those macroscopically considered very fat, and by the lack of similar regular variations for grades of flour etc.

The maxima and minima are not to be considered absolutely such. Most of the statements of maxima, minima and averages in the original table are computed from three or four analyses, some from only two. When only an average statement is found, it indicates either that there is usually no great variation or that the maxima and minima in the original table represent only two or three analyses which do not vary greatly.

So far as possible—and explicit information is often lacking in the original table—protein and carbohydrate percentages are corrected to show true proteid and digestible carbohydrate. For meats, the $N \times 6.25$ and protein by difference from 100% have been themselves averaged, so far as possible. For vegetables, many of the statements as to proteid are excessive, there being no estimate of proteid proper. This error is not of much practical importance since, if the percentage of proteid is large, as in

the legumes, the non-proteid nitrogenous substances are comparatively insignificant; while, if the total nitrogenous constituents are small, the error for any ordinary use of the food stuff is slight in the aggregate.

In computing the maxima and minima of digestible carbohydrate in vegetables, the rule has been followed to subtract the largest number for fibre from the smallest number for total carbohydrate and vice versa, although, in certain cases, it has appeared fairer to estimate the cellulose as roughly proportionate to the total carbohydrates, and in others only the average or the analysis of one or a few samples has been available for the cellulose estimation.

In general, the difference between 100% of edible food stuff and the sum of proteid, fat and carbohydrate percentages, consists of 1—3% of ash (mineral matters) and of water. An exact footing up to 100% can not be expected. For instance, in the original table, sausages are stated to contain from 0.2 to 8.6% of "carbohydrate" although qualitative tests show no carbohydrate whatever.

Owing to the impossibility of absolute exactitude, the liberty has been taken to state fractions of a per cent. in the nearest half per cent., excepting when the percentages for any one organic ingredient are small—usually less than 10—or when it appears that a fairly accurate comparison can be made with some related food stuff, as in the case of different grades of flour.

Obviously, in using tables to ascertain the organic nutrients of food eaten, only approximate results can be obtained, so that it will suffice to use average figures and to ignore fractions of a per cent. or even to use the nearest aliquot fraction of the whole.

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT.

Cut.	Percentage Wasted in Preparing for Cooking	Percentage of Nutrients in Edible Parts.		
		Proteid.	Fat.	Carbohydrate.
ANIMAL FOODS—FRESH BEEF.				
Brisket	14—30 av. 23	14—17 av. 16	22.5—37 av. 28.5	
Chuck, including rib	12—34 av. 17	14—20 av. 19	4—32 av. 15.5	
Chuck	5—33 av. 19	14—22 av. 19	1.5—32 av. 13.5	
Flank	1—36 av. 5.5	12 5—28.5 av. 19	1—60 av. 21	
Loin	3.5—26 av. 13	14—27 av. 19	1—34 av. 19	
Loin, boneless strip	....	16—23 av. 16	4—32 5 av. 17	
" Porterhouse	av. 13	av. 19	av. 20	
Sirloin	av. 13	av. 18.5	av. 18.5	
Tenderloin	....	12—18 av. 16	17—30 av. 25	
Neck	20—75 av. 31	18.5—24 av. 20	1—20 av. 13	
Rib rolls	....	16—22 av. 19	4 5—32 av. 15.5	
Round	1—20 av. 8.5	16—24.5 av. 20.5	1—28 av. 11	
" free from visible fat, etc	....	av. 23	av. 2.5	
Rump	1.5—31.5 av. 19	11—26 av. 15	1—44 av. 23	
" free from visible fat, etc.	....	av. 21	3.5	
Fore shank	26—50 av. 38	18.5—24 av. 21	1.5—21.5 av. 8	
Hind shank	50—68 av. 55.5	18.5—26 av. 21	1 5—19 av. 9	
Shoulder and clod (Clod usually has no waste.)	5.5—53.5 av. 17.5	17—22.5 av. 20	1—21.5 av. 10	
Clear fat	....	av. 4	av. 82	
Brain (edible portion)	....	9	av. 9.5	
Heart " "	....	16	14.5—26 av. 20.5	
Kidney "	....	17	2 5—7 av. 5	0.4
Liver "	....	18—23 av. 21	3—6 av. 4 5	1.3—2.5 av. 1.6
Lungs	....	16	3	
Marrow	....	2.5	93	
Sweetbreads	....	16	12	

Suet	......	1—7.5 av. 4.5	71—94.5 av. 82	
Tongue	9—55 av. 26.5	17—22 av. 19	1—18 av. 9	
COOKED BEEF.				
Roast beef	......	15—29 av. 22	19.5—41.5 av. 28.5	
Round steak, fat removed	......	20—34 av. 27.5	3.5—17 av. 7.5	
Baked sirloin steak	......	24	10	
Broiled tenderloin steak	......	20—26.5 av. 23.5	12—35.5 av. 20.5	
CANNED COOKED BEEF.				
Boiled beef	......	24.5	22.5	
Corned beef	......	20—34 av. 25.5	12—31 av. 18.5	
Dried Beef	......	39	5.5	
Roast beef	......	20—30 av. 25	9—23.5 av. 15	
Rump steak	......	23.5	18.5	
Sweetbreads	......	20	9.5	
Oxtails	30	25	6	
Ground tongue	......	20—23 av. 21	16—33 av. 23	
Tripe	......	17	2 5—14.5 av. 8.5	
CORNED AND PICKLED BEEF.				
Corned beef	5—14.5 av. 8.4	12—19 av. 14	12—49 av. 26	
Spiced beef, rolled	......	12	51	
Pickled tongue	2—10 av. 6	8—17 av. 12.5	15—26 av. 20 5	
Tripe	......	7—18.5 av. 12	1—2 av. 1.2	.2—.5 av. .4
Dried salted and smoked	4.5	24.5—47 av. 30	3—12 av. 6.5	.4
FRESH VEAL.				
Breast	15—47 av. 24.5	18—23 av. 20	2.5—15.5 av. 11	
Chuck	17.5—20 av. 19	14.5—20.5 av. 19.5	2—8.5 av. 6	

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT.

Cut.	Percentage Wasted in Preparing for Cooking.	Percentage of Nutrients in Edible Parts.		
		Proteid.	Fat.	Carbohydrate.
FRESH VEAL.				
Flank	....	18—21 av. 19.5	8—24 av. 13	
Leg	4.5—25.5 av. 12	18—22.5 av. 20.5	1—12 av. 7	
Loin	12—29 av. 19	18—21 av. 19.5	5—19.5 av. 10	
Neck	21.5—50 av. 31.5	19—20 av. 19.5	4—9 av. 7	
Rib	13—41 av. 25	17.5—21.5 av. 20	3.5—31.5 av. 9.5	
Rump	30	20	16	
Fore shank	20.5—52.5 av. 40.5	19—20.5 av. 20	4—6.5 av. 5	
Hind shank	51.5—65 av. 61	18—21 av. 20	3—11 av. 5.5	
Shoulder (lean)	11.5—25 av. 18	20.7	3—6 av. 4.5	
Heart	....	16.5	9.5	
Kidneys	....	16.5	6.5	
Liver	....	20.5	5.3	
Lungs	....	17	5	
FRESH LAMB.				
Breast	19	19	23.5	
Hind Leg	7—17 av. 14	17—19 av. 18	15—30 av. 22.5	
Leg, free from fat and bone	....	24	2.5	
Loin, without kidney or tallow	12—17.5 av. 15	15.5—19 av. 17.5	25—35 av. 28	
Neck	17.5	17.5	25	
Shoulder	20	17.5	29.5	
Fore quarter	19	18	26	
Hind quarter	15.5	16	16	
Side without tallow	17—21.5 av. 19	16.5—18.5 av. 17.5	21—25.5 av. 23	

COOKED LAMB.

Chops, broiled	13.5	19—23.5 av. 21	24—34.5 av. 30	
Leg roasted	......	19.5	12.5	
Spiced tongue	2.5	14	18	

MUTTON.

Chuck	14.5—25 av. 19.5	9.5—18 av. 14	16—60 av. 37	
Flank	2—17.5 av. 10	9.5—16 av. 14	32—65 av. 42.5	
Hind leg	3.5—25 av. 17.5	17—20 av. 18.5	12—27 av. 17.5	
Loin without kidney or tallow	11.5—24 av. 15	10—19 av. 15	26—58.5 av. 36	
Loin with fat removed	......	24	18.5	
Neck	16—35 av. 26.5	12—20 av. 16	18—43.5 av. 26.5	
Shoulder	14.5—27 av. 22	15—19 av. 17	13—35.5 av. 22	
Edible part of leg, roasted	......	11—14 av. 13	18—42 av. 24	
Heart (raw)	......	15.5—18 av. 17	12—13.5 av. 12.5	
Kidney	......	16.5	3	
Liver	......	23.5	4.5—13 av. 9	2.1—7.9 av. 5
Lungs	......	19—21.5 av. 20	2.5—3	
Canned corned mutton	......	27	23	
Canned tongue	......	24	24	

FRESH PORK.

Chuck ribs and shoulder	16—20 av. 18	17	31	
Flank	11.5—24 av. 18	16.5—19 av. 18	19.5—27 av. 22	
Fresh ham	2—16 av. 10.5	8—30 av. 15.5	13—61 av. 13.5	
Head	52—77 av. 68.5	11—14.5 av. 13	34.5—50 av. 41.5	
Head cheese	12	18—21 av. 19	27.5—40.5 av. 34	
Loin chops	11.5—28 av. 19.5	11—20 av. 16.5	25—48.5 av. 32	
Tenderloin	......	16—21 av. 19	9.5—17 av. 13	
Shoulder	4—21 av. 12.5	9.5—17 av. 13	18.5—49 av. 34	
Side exclusive of lard and kidney	8—14 av. 11.5	7—12 av. 9.5	44—64.5 av. 55.5	
Brain	......	12	10.5	

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT.

CUT.	Percentage Wasted in Preparing for Cooking.	Percentage of Nutrients in Edible Parts.		
		Proteid.	Fat.	Carbohydrate.
FRESH PORK.				
Heart.		17	6	
Kidneys		15.5	5	
Liver		21.5	4.5	1.4
Lungs		12	4	
Marrow		1.5—3 av. 2.5	78.5—84.5 av. 81	
PORK, PICKLED, SALTED AND SMOKED.				
Ham (raw, smoked)	2—28.5 av. 12	10—20 av. 16.5	17—55.5 av. 39	
Smoked ham, boiled		18—22 av. 20	8—37 av. 22.5	
" " fried		23	33	
Boneless smoked ham, raw		18—22 av. 20	17—39 av. 28.5	
Smoked shoulder	14—26 av. 19	12—16.5 av. 15.5	29—58 av. 41	
Pickled tongues	1—5 av. 3	18	16.5—23 av. 20	
Pickled feet	27—44.5 av. 35.5	13—19 av. 16	11.5—18 av. 15	
Salt pork, clear fat		0.5—4.5 av. 2	80—94 av. 86	
Salt pork, lean ends	9—14 av. 11	6.5—9.5 av. 7.5	62.5—70 av. 67	
Bacon	3—24.5 av. 8.5	6.5—17 av. 10	40—79.5 av. 65	
CANNED PORK.				
Brawn boar's heads		18—30 av. 24	13—33 av. 23	
Deviled ham		16.5—21 av. 18.5	29.5—39 av. 34	

SAUSAGES—1.5—10 for case.

Arles	....	25	50.5	
Banquet	....	18	15.5	
Bologna	....	15—21 av. 18.5	11—24 av. 17.5	
Farmer	....	27	42	
Frankfort	....	15—27.av. 19.5	15—26 av. 18.5	
Holsteiner	....	29.5	37.5	
Lyons pure ham	....	32.5	27	
Pork	....	7.5—18 av. 13	28—57 av 44	
Pork sausage meat	....	17.5	32.5	
Pork and beef	....	19.5	24	
Salmi	....	23	40	
Summer	....	23—29 av. 26	43—45.5 av. 44.5	
Tongue	....	20	33	
Wienerwurst	....	28	22	
Canned beef sausage	....	18	20.5	
" Italian bologna	....	24	27.5	
" Frankfort	....	14.5	10	
" Oxford	....	10	58.5	
" pork	12.5 waste liquid	16.5	25	

POULTRY.

Chicken broilers	31.5—55 av. 41.5	19—25 av. 21.5	1.5—4 av. 2.5	
"Fowls"	18—42.5 av. 26	15—22 av. 19	9.5—28.5 av. 16.5	
Young goose	17.5	16.5	36	
Turkey	17—32.5 av. 22.5	19—24 av. 21	8.5—30.5 av. 23	
Chicken gizzard	....	24.5	1.5	
" heart	....	21	5.5	
" liver	....	22.5	4	2.4
Goose gizzard	....	19.5	8	
" liver	....	16.5	16	3.7
Turkey gizzard	....	20.5	14.5	1.2
" heart	....	17	13	
" liver	....	23	5	0.6

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT.

Cut.	Percentage Wasted in Preparing for Cooking.	Percentage of Nutrients in Edible Parts.		
		Proteid.	Fat.	Carbohydrate.
POULTRY.				
Capon cooked	10.5	27	11.5	
" with stuffing	7.5	22	11	3.8
Fricasseed chicken		17.5	11.5	2.4
Roast turkey		28	18.5	
" " with stuffing		17	11	5.5

FISH. (Note. The waste of whole fish is about 50—65% for those of medium size, down to about 30% for large fish. Cuts of large fish analogous to cuts of meat average about 10% waste. The proportion of proteid and fat is, as hitherto, for the edible portion.)

Cut.	Percentage Wasted in Preparing for Cooking.	Proteid.	Fat.	Carbohydrate.
Alewife		19.5	4—6 av. 5	
Black bass		19.5—21.5 av. 20.5	1—2.5 av. 1.7	
Red bass		17	0.5	
Seabass		19	0.5	
Striped bass		17—19.5 av. 18.5	1.5—4.5 av. 3	
Black fish		17.5—19.5 av. 18.5	0.6—2.8 av. 1.3	
Blue fish		19	1.2	
Buffalo fish		18	2.3	
Butter fish		18	11	
Cat fish		14.5	20.5	
Cisco		17.5—19 av. 18.5	3.5—9 av. 6.8	
Cod		15—18 av. 16	0.3—0.5 av. 0.4	
Cusk		17	0.2	
Salt water eels		17.5—19 av. 18.5	8—10.5 av. 9	
Flounder		13—15 av. 14	0.4—0.8 av. 0.6	
Haddock		16—18.5 av. 17	0.1—0.4 av. 0.3	

Hake		15	0.7	
Halibut steaks or sections		17.5—19.5 av. 18.5	2.2—10.6 av. 5.2	
Herring		19	3.2—11 av. 7.1	
King fish		18.5	0.9	
Lamprey		15	13.5	
Mackerel		17.5—19.5 av. 18.5	2.2—16.3 av. 7.1	
Mullet		19.5	4.6	
Muskellunge (sic)		20	2.5	
Perch white		18—20.5 av. 19	2.5—5.6 av. 4	
Perch pike (wall-eyed pike)		18.5	0.5	
Perch yellow		18—19.5 av. 18.5	0.6—1.1 av. 0.8	
Pickerel		18.5	0.5	
Grey pike		17.5	0.8	
Pollock		21.5	0.8	
Pompano		19	1.6—13.5 av. 7.5	
Porgy		17.5—19.5 av. 18.5	1.5—7.9 av. 5.1	
Red grouper		19	0.6	
Red snapper		19.5	0.5—1.9 av. 1	
Salmon		19—25 av. 21.5	10—15 av. 13	
Landlocked salmon		16.5—19 av. 18	2—4.4 av. 3.3	
California salmon		17.5	16.5—19 av. 18	
Shad		18—20 av. 18.5	6.5—13.5 av. 9.5	
" roe		21	3.8	2.6
Sheepshead		19.5	0.7—6.7 av. 3.7	
Skate (lobe of body)		16	1.4	
Smelt		17.5	1.8	
Spanish mackerel		21	9.5	
Sturgeon		18	1.9	
Tom cod		17	0.4	
Brook trout		19	0.8—2.9 av. 2.1	
Salmon or lake trout		17.5	8.1—12.6 av. 10.3	
Turbot		13	14.5	
Weak fish		17.5	2.4	
White fish		22.5	6.5	
Cooked blue fish		26	4.5	
" Spanish mackerel		23.5	6.5	

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT.

	Percentage Wasted in Preparing for Cooking.	Percentage of Nutrients in Edible Parts.		
		Proteid.	Fat.	Carbohydrate.
PRESERVED AND CANNED FISH.—(Waste very variable, according to method of preparation. Oil used for sardines etc. considered as waste. Percentages apply to edible portion.)				
Salt cod	....	21—28 av. 26	0.2—0.4 av. 0.3	
Smoked haddock	....	23	0.2	
" halibut	....	18.5—23 av. 20.5	14.5—15.5 av. 15	
herring	....	36.5	16	
Canned lamprey	....	17	12	
Salt mackerel	....	17	25—28 av. 26.5	
" " in oil	....	24	14	
Minogy pickled	....	27	18.5	
Canned salmon	....	19—24.5 av. 22	5.3—21.5 av. 12.1	
" sardines	....	20—25 av. 22.5	12.7—26.7 av. 19.7	
Dried Russian sturgeon	....	32	9.6	
Pressed " " caviare	....	30	19.5	7.6
Brook trout	....	22.5	6.1	
Tunney	....	21.5	4.1	
" Russian, in oil	....	24	20	0.6
AMPHIBIA, SHELLFISH AND CRUSTACEANS.				
Frogs' legs	32	13—17.5 av. 15	0.2	
Terrapin	75.5	21	3.5	
Green turtle	76	19	0.5	
Long clams	40—45 av. 42	8—9 av. 8.6	1—1.2 av. 1.1	1.6—2.5 av. 2
Round clams	67.5	6.5—10.5 av. 8.5	0.4—1.1 av. 0.8	4.2—5.2 av. 4.7
Hardshell crabs	52.5	16.5	2	1.2
Crayfish	86.5	16	0.5	1
Lobster	44—73.5 av. 61.5	11.5—25.5 av. 16.5	1.5—2.8 av. 1.8	0.5

Mussels	46.5	8.7	1.1	4.1
Oysters	74—88.5 av. 81.5	4.5—10 av. 6	0.5—1.9 av. 1.3	0.7—2.8 av. 1.8
Scallops		15	0.2	1.1—5.6 av. 3.4
Canned clams long		9	1.3	2.9
" " round		10.5	0.8	3
" Crabs		16	0.8—2.3 av. 1.5	0.8
" Lobster		16.5—19.5 av. 18	0.5—1.7 av. 1.1	2.1—2.8 av. 2.5
" Oysters		7—13 av. 8.8	2—3.4 av. 2.4	2.6—5.2 av. 3.9
" Shrimps		25.5	1	0.2
EGGS AND DAIRY PRODUCTS.				
Hens' eggs	11.2	11.5—17.5 av. 14.5	8.6—15 av. 10.5	
" " boiled		10—16.5 av. 13.5	9—14.5 av. 12	
" " whites		11.5—15.5 av. 12.5	0.2	
" yolks		15.5—18 av. 16	32.2—34.4 av. 33.3	
MILK AND ITS DERIVATIVES.				
Whole milk (average)		3.3	4	5
Skimmed milk "		3.4	0.3	5.1
Whey		1	0.3	5
Condensed unsweetened milk		8.6—10.5 av. 9.6	7.8—10.4 av. 9.3	10.4—12.2 av. 11.2
Condensed sweetened milk		6—10.5 av. 8.8	0.4—10.6 av. 8.3	44.5—57 av. 54 (av. cane sugar 43.5)
Cream (average)		2.5	18.5	4.5
Koumiss		2.6—3 av. 2.8	1.7—2.4 av. 2.1.	5.1—5.9 av. 5.4
	(av. 4.4% cane sugar and 0.76% alcohol)			
Butter		1	85	
Buttermilk		3	0.5	4.8
CHEESE.				
American, pale		28.8	36	
" red		29.5	38.5	
Boudon		15.5	21	0.7
California flat		24.5	33.5	4.5
Cheddar		27.5	37	4.1

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT.

	Percentage Wasted in Preparing for Cooking.	Percentage of Nutrients in Edible Parts.		
		Proteid.	Fat.	Carbohydrate.
CHEESE.				
Cheshire		27	30.5	
Cottage		16—25.5 av. 21	0.4—1.6 av. 1	3.7—4.9 av. 4.3
Cream (Crown brand)		5	58	2.2
Dutch		29.5—44.5 av. 37	16.5—19 av. 17.5	8.5—11.5 av. 10
Full cream		18—37 av. 26	24.5—44.5 av. 33.5	1.2—4 av. 2.4
" " imitation		26	31.5	
Brie		16	21	1.4
Old English imitation		30	42.5	1.3
Limburger		23	29.5	0.4
Neuchatel		15—22.5 av. 18.5	22.5—32.5 av. 27.5	0.2—2.9 av. 2.4
Partly skimmed milk		23.5—27.5 av. 25.5	23.5—34.5 av. 29.5	2.3—4.9 av. 3.6
Pineapple		27—34.5 av. 30	33.3—45 av. 39	2.2—3.1 av. 2.6
Roquefort		22.5	29.5	1.8
Skimmed milk		26.5—38.5 av. 31.5	6.8—27 av. 16.5	up to 9 av. 2.2
Swiss		26—29 av. 27.5	33—36.5 av. 35	0.9—1.7 av. 1.3
MISCELLANEOUS ANIMAL FOODS.				
Gelatin (14—17 av. 16% water and ash, 0.1—0.4% fat, remainder nitrogenous organic matter.)				
Sturgeon isinglass (1.6% fat. 77.4% nitrogenous organic matter.)				
Refined lard			100	
Unrefined "		1.7—2.9 av. 2.2	92—96 av. 94	
Refined tallow and cottolene each			100	
Oleomargarine		1.2	83	
Beef juice		4.9	0.6	
Canned soups 81.6—96.7 water		1.7—6.1	0.1—2.8	0.1—11.1

CEREAL FLOURS AND MEALS.—(Excepting those which are specially dried or marketed in more or less air-tight packages or which may be considered damp, and those which contain considerable fat—5% or more—the water is rarely under 10 nor over 13%. As a rule, those containing considerable fat, contain little water, the sum of water and fat being about 10—13%. Only bran and chaff that can be removed by sifting, is considered waste. This is nil for most flours, 5—25%, average 10% for corn meal etc.) Cellulose is subtracted from the carbohydrate figures, so far as information is afforded by the tables.

Barley granulated	....	7.5	0.9	79
" meal and flour	....	9—12.5 av. 10.5	1.5—3.2 av. 2.2	64—68 av. 66.5
" pearled	....	7—10.1 av. 8.5	0.7—1.5 av. 1.1	77—78 av. 77.5
Buckwheat flour	....	4—10.5 av. 6.5	0.5—2.3 av. 1.2	71—81 av. 77.5
" farina and groats	....	3.3—4.8 av. 4.1	0.3—0.6 av. 0.4	83—84.5 av. 84
" self-raising flour	....	5.5—11 av. 8	0.3—1.4 av. 1.2	70—77 av. 73
Corn meal	....	8—9.5 av. 8.5	4.5—5.2 av. 4.7	71.5—75 av. 73.5
Popcorn (4.3% water)	....	10.5	5	77
Corn cerealine	....	9—10 av. 9.5	0.9—1.3 av. 1.1	76—79 av. 78
" hominy	....	6.3—9.5 av. 8.3	0.2—1 av. 0.6	76—79 av. 78
" cooked (water 79)	....	2.2	0.2	17
parched (water 5—5.5)	....	11.5	8.5	72
Kaffir corn (water 17)	....	6.6	3.8	69.5
Oatmeal (water 2—8.8 av. 7.3)	....	13—21 av. 16	6—8.8 av. 7.2	63—70 av. 67.5
" boiled (water 84.5)	....	2.8	0.5	11.5
gruel (water 87.5—95.7)	....	0.9—1.6	0.2—0.5	2.9—9.6
Rice	....	5.9—11.3 av. 8	0.1—0.7 av. 0.3	75—81.5 av. 79
" boiled (water 52—82%)	....	1.6—5 av. 2.8	0.1	15.5—42 av. 24.5
" flaked	....	7.5—8.3 av. 7.9	0.3—0.5 av. 0.4	81—82 av. 81.5
flour	....	4.7—12 av. 8.6	1.7—10.4 av. 6.1	av. 52
(used mainly as fodder, 3.7—10.9 water, fibre 9.1—28.3.)				
Rye flour	....	4.9—8.8 av. 6.8	0.2—1.3 av. 0.9	77—80 av. 78.5
" meal	....	13.5	2	70
Wheat flour..				
California fine	....	7.2—8.8 av. 7.9	1.2—1.6 av. 1.4	74—77.5 av. 76.5
Whole wheat	....	12.2—14.6 av. 13.8	1.5—2.1 av. 1.9	68.5—76 av. 71
Gluten	....	12.8—15 av. 14.2	1.1—2.4 av. 1.8	69—72 av. 70.5
Graham	....	8.5—17.7 av. 13.3	1.5—3.6 av. 2.2	64—74 av. 69.5

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT.

	Percentage Wasted in Preparing for Cooking.	Percentage of Nutrients in Edible Parts. Proteid.	Fat.	Carbohydrate.
CEREAL FLOURS AND MEALS. WHEAT.				
Self-raising		8—13.3 av. 10.2	0.6—2.2 av. 1.2	67—78 av. 72.5
Roller process except low grade		8.4—14.9 av. 11.4	0.3—2 av. 1	70—79 av. 75
(No significant average difference as to spring or winter wheat or grade, except that low grade roller flour averages almost exactly as gluten.)				
Wheat cracked and crushed		9.5—12.9 av. 11.1	1.3—2.2 av. 1.7	72—75 av. 73.5
" farina		10.4—11.7 av. 11	0.8—3.8 av. 1.4	74—78 av. 76
flaked		9 7—15.6 av. 13.4	1.1—1.5 av. 1.4	68—77.5 av. 72.5
" germs		8.6—13.4 av. 10.5	1.2—2.5 av. 2	72—79 av. 75
" glutens		12.7—14.4 av. 13.6	0.7—3.3 av. 1.7	67—77 av. 73
" 22 cereals		10.4—16.6 av. 13.1	1.3—4 av. 2.1	69.5—80 av. 73
" parched		11.8—15.5 av. 13.6	0.9—3.7 av. 2.4	72—76 av. 73.5
shredded		9.6—11.4 av. 10.5	1.3—1.6 av. 1.4	73—78 av. 76
macaroni		7.9—16.6 av. 13.4	0—4.9 av. 0.9	67—78 av. 74
" cooked (water 78.5)		3	1.5	16
noodles		11.7	0.5—1.5 av. 1	74.5—76 av. 75
" spaghetti		10—11.1 av. 10.6	0.1—0.8 av. 0.4	74—76.5 av. 76
vermicelli		7.9—16.4 av. 10.9	0.3—5 2 av. 2	66.5—76.5 av. 72
BREAD—(water about 30—40%.)				
Brown		5.5	1.2—2.4 av. 1.8	43—50 av. 47
Cassava (10% water)		9.1	0.3	79
Corn (Johnny cake)		6.5—10.1 av. 7.9	2.3—9.8 av. 4.7	40—54 av. 46
Rye		6.4—11.1 av. 9	0.1—1.4 av. 0.6	45—65 av. 53
" black		9.6	0.6	49

Rye and wheat	....	11.9	0.3	51
Buns (various kinds)	....	6.3—9.4	6.5—9.4	49—59
Gluten bread	....	8.2—11.1 av. 9.3	0.7—2.4 av. 1.4	44.5—53 av. 50
Graham bread	....	6.8—10.9 av. 8.9	0.4—3.8 av. 1.8	38—57.5 av. 51
Soda biscuit etc.	....	7.5—10.2	2—13.7	53—58.5
Rolls	....	8—11.9 av. 8.9	0.4—9.4 av. 4.1	52—59.5 av. 56
White bread	....	6.5—16.3 av. 9.2	0—3.8 av. 1.3	41.5—60.5 av. 52.5
Zwieback (5—7.7 av. 5.8 water)	....	8.6—11.7 av. 9.8	8.1—11.3 av. 9.9	72—74 av. 73.5

CRACKERS.—(Water 3—12%, usually about 7. Those rich in fat contain less water, the sum of water and fat being about 15.)

Boston	....	11	7.1—9.9 av. 8.5	68—72.5 av. 70.5
Butter	....	9.2—11.2 av. 9.6	8—13.6 av. 10.1	69—76 av. 71
Cream	....	8.6—11.2 av. 9.7	10.7—13.8 av. 12.1	68—71.5 av. 69
Egg	....	12.5	12—16 av. 14	63.5—69 av. 66
Flat bread	....	13.5—15.5 av. 15	0.2—0.7 av. 0.5	72—75 av. 73
Graham	....	7.4—14.4 av. 10	1.1—13.6 av. 9.4	69—77 av. 72.5
Miscellaneous	....	7.1—14.2 av. 10.2	0.5—12.8 av. 8.8	63—82 av. 72
Oatmeal (water 4.9—7.8 av. 6.3)	....	10.5—13 av. 12	8.5—13.7 av. 11.1	66.5—67.5 av. 67
Pilot bread (hard tack)	....	10.5—12.5 av. 11	0.5—10.2 av. 5	70—77 av. 74
Pretzels	....	9.1—10.3 av. 9.7	3.9	70.5—74 av. 72.5
Saltines	....	10.5	12.5	68
Soda	....	8.8—10.7 av. 9.8	7.7—10 av. 9.1	70—75 av. 73
Water	....	10.4—12.5 av. 11.7	0.2—10.1 av. 5	72—80 av. 75.5
All analyses average	....	10.7	8.8	71.5

CAKE.—(Water 6—33%, lower figure for sponge cake, usually about 20%. Plain cake may contain more sugar than frosted.)

Cake	....	4.6—8 av. 6.3	3.4—15.6 av. 9	52—74 av. 63

COOKIES.—(Water 4—13 av. 8%.)

Cookies	....	4.3—8 av. 7	3.9—16.7 av. 9.7	61—81.5 av. 73
Fig bars (18% water)	....	4.6	6.6	73

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT.

	Percentage Wasted in Preparing for Cooking.	Percentage of Nutrients in Edible Parts. Proteid.	Fat.	Carbohydrate.
COOKIES.				
Ginger snaps (4.3—9.7 av. 6.3 water)	....	5.8—7.3 av. 6.5	2.3—15.4 av. 8.6	71.5—80 av. 75
Lady fingers (10.5—21.7 av. 15 water)	....	6.8—10.5 av. 8.8	3.1—7.6 av. 5	67.5—72.5 av. 70.5
Macaroons (5.9—27.5 av. 12.3 water)	....	3.1—10.6 av. 6.5	9.6—21.5 av. 15.2	56.5—70 av. 64
Wafers	....	2.8—10.4 av. 7.6	2.5—19.6 av. 11.6	63—81 av. 72.5
Miscellaneous cakes (3.2—17.9 av. 8.2 water)	....	4.2—13.1 av. 7.6	1.7—17 av. 9	62—84 av. 73.5
Doughnuts (11—25.8 av. 18.3 water)	....	5.1—7.6 av. 6.7	16.4—25.7 av. 21	45—62.5 av. 52.5
Jumbles (6.7—24.8 av. 14.3 water)	....	6.3—7.9 av. 7.4	10.9—15.7 av. 13.5	51—72 av. 63
PIE.—(32—64% water).				
Pie	....	2.6—7.5	6.3—14.5	30—51
(Owing to the relatively greater amount of pie crust as compared with filling, the different kinds of pie do not vary greatly on the average. The lower crust should almost never be eaten and the upper crust seldom.)				
PUDDINGS.				
Indian meal	....	5.5	4.8	27.5
Rice custard	....	4	4.6	31.5
Tapioca	....	2.8—4.2 av. 3.3	2.3—4.8 av. 3.2	30—28 av. 28
" and apple	....	0.3	0.1	29

NEARLY PURE CARBOHYDRATES.

Candy (average)	....	....	....	96
Honey	....	0.2—1.1 av. 0.4	....	77.5—85.5 av. 81
Molasses	..(Up to 1% nitrogen, not proteid)		0.2	59—76.5 av. 69.5
Arrowroot starch	....	....	....	97.5
Manioc starch	....	0.5	0.1	89
Corn starch	....	....	....	90
Sago	....	9.	0.4	78
Tapioca	....	0.2—0.6 av. 0.4	0.1—0.3	86.5—89 av. 88
Sugar, coffee or brown	....	....	....	95
" granulated	....	....	....	100
" maple	....	....	....	74—95 av. 83
" powdered	....	....	....	100
Maple syrup	....	....	....	46—82 av. 71.5

VEGETABLES.—(Fresh vegetables contain 70—95% of water, approximately indicated by their succulence. Dried vegetables contain about 10% of water. Waste refers to peelings, pods, pits, etc.)

Artichokes	....	1.2	0.2	16
Asparagus	....	1.8	0.2	2.5
Beans, green butter	50	9.4	0.6	29
" dried	....	13—26.5 av. 22.5	1.4—3.1 av. 1.8	52—60 av. 55
" frijoles	....	21—24.5 av. 22	1—1.5 av. 1.3	61—67 av. 65
" Lima dried	....	12.8—24.5 av. 18.1	0.6—1.9 av. 1.5	61.5—70 av. 66
" " fresh	55	7.1	0.7	20
Mesquite dry	....	12.2	2.5	77
string	7	1.7—2.8 av. 2.3	0.2—0.4 av. 0.3	2.5—10.5 av. 5.5
Beets	20	0.9—3 av. 1.6	0.1—0.2	3—14.5 av. 8
Cabbage	15	tr—1.5 av. 1	0.1—0.7 av. 0.3	3—6.5 av. 4.5
" sprouts	62	4.7	1.1	4.3
Carrots	20	0.4—1 av. 0.5	up to 0.7 av. 0.4	5.5—12 av. 8
" evaporated	....	4	3.6	80
Cauliflower	....	1	0.2—0.8 av. 0.5	3—5 av. 3.5
Celery	20	1	0.1—0.2 av. 0.1	3—4.6 av. 3.3
Collards	55	1.7—2.9 av. 2.3	0.5—0.7 av. 0.6	6.2—6.5 av. 6.3

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT.

	Percentage Wasted in Preparing for Cooking.	Percentage of Nutrients in Edible Parts.		
		Proteid.	Fat.	Carbohydrate.
VEGETABLES.				
Green corn	61	2 2—3 av. 2.5	1	13.5—22 av. 19
Cucumbers	15	0.3—0.5 av. 0.4	0.1—0.5 av. 0.2	1.5—3 av. 2.4
Egg plant		0 6	0.3	4.3
Beet greens cooked		2	3.4	3.2
Dandelion greens raw		2.4	1	10.6
Turnip greens		4	0.6	6.3
Kohl rabi		0.5	0.1	4.2
Leeks	15	1	0.5	5
Lentils dry		25.5	1	59
Lettuce	15	0.4—1 av. 0.7	0.1—0.6 av. 0.3	0.5—4 5 av. 2.2
Mushrooms		1.2—4 av. 2.5	0.2—0.9 av. 0.4	0 5—20 av. 6
Okra	12.5	1—2 av. 1.5	0.1—0.4 av. 0.2	2.5—6 av. 4
Onions, fresh		0.2—4.3 av. 1.6	0 1—0.8 av. 0.3	3—14.5 av. 9 1
" cooked		1.2	1.8	4.9
" green N. Mex.	51	1	0.1	11
Parsnips	20	1.4—1.9 av. 1.6	0.2—0.8 av. 0.5	6.5—14.5 av. 11
Peas dry		20.5—28 av. 24.5	0 8—1.3 av. 1	50—66 av. 57.5
" green	45	4.3—8 av. 7	0.3—0.6 av. 0.5	11.5—17 av. 16
" cooked		6.7	3.4	14.5
Sugar peas green		3 4	0.4	12
Cow peas green		9.4	0.6	22.7
Potatoes raw	20	0.6—1.7 av. 1.2	up to 0.2 av. 0.1	13—27 av. 18
" evaporated		2.5—4.5 av. 3 5	0 4	80
boiled		1—1.6 av. 1.3	0—0.4 av. 0.1	15.5—26 av. 20
cooked chips		3.5	35.5—44 av. 39	42—50 av. 46
" mashed and creamed		1.5	1.5	13—22 av. 17

Sweet potatoes	20	0.3—2.5 av. 1.3	0.2—1.4 av. 0.7	13—43 av. 26
" " cooked	.....	2	2.1	42
Pumpkins	50	1	0.1	3—5 av. 4
Radishes	30	0.5—3 av. 1.3	0—0.3 av. 0.1	2.7—7.6 av. 5.1
Rhubarb	40	0.2—0.5 av. 0.3	0.1—1.2 av. 0.7	2—4.3 av. 2.5
Ruta baga	30	0.4—0.9 av. 0.5	0.1—0.3 av. 0.2	6—10 av. 7.3
Sauerkraut	.....	1.5—1.9 av. 1.7	0.2—0.8 av. 0.5	3.3—4.4 av. 3.8
Spinach	.....	1—1.5 av. 1.3	0.2—0.5 av. 0.3	2.1—2.5 av. 2.3
" cooked	.....	1.3	4.1	1.7
Squash	50	0.5—3.6 av. 1.3	0.1—1.4 av. 0.5	2.5—15.5 av. 8.2
Tomatoes	.....	0.2—0.8 av. 0.5	0.2—1.4 av. 0.4	1—6 av. 3.3
Turnips	30	0.2—1 av. 0.4	0.1—0.4 av. 0.2	1.5—23 av. 6.8

CANNED VEGETABLES.

Artichokes	.....	0.5—1 av. 0.8	.....	3.1—6.3 av. 4.4
Asparagus	.....	0.9—2.4 av. 1.5	0—0.2 av. 0.1	1.5—3.7 av. 2.3
Baked beans	.....	5.1—8.1 av. 6.9	0.3—6.8 av. 2.5	9—22 av. 17
String beans	.....	0.6—4 av. 1.1	0—0.5 av. 0.1	1.5—13 av. 3.3
Little green beans	.....	1.2	0.1	2.8
Wax beans	.....	1	0.1	2.5
Haricots verts	.....	0.9—1.4 av. 1.1	0—0.3 av. 0.1	1.6—2.4 av. 2
Haricots flagolets	.....	4—5.2 av. 4.6	0—0.1	9.8—12.4 av. 11.5
Haricots panaches	.....	3.7	.....	8.2
Lima beans	.....	3.2—5.6 av. 4	0.2—0.6 av. 0.3	9.1—17 av. 13.4
Red kidney beans	.....	7	0.2	17.3
Brussels sprouts	.....	1.5	0.1	2.9
Green corn	.....	2—3.7 av. 2.8	0.5—1.9 av. 1.2	8.6—25 av. 18.2
Okra	.....	0.5—0.9 av. 0.7	0—0.2 av. 0.1	1.9—3.5 av. 2.9
Green peas	.....	1.6—6.1 av. 3.6	0—0.8 av. 0.2	3.4—16.8 av. 8.6
Sweet potatoes	.....	1.3—2.6 av. 1.9	0.3—0.5 av. 0.4	27.5—45.5 av. 40.5
Pumpkin	.....	0.5—1.2 av. 0.8	0.1—0.4 av. 0.2	3.2—9 av. 5.6
Squash	.....	0.2—1.6 av. 0.9	0.1—1.2 av. 0.5	7.1—13.6 av. 9.8
Succotash	.....	2.9—4.4 av. 3.6	0.7—1.7 av. 1	13.8—21.7 av. 17.7
Tomatoes	.....	0.3—1.7 av. 1.2	0.1—0.3 av. 0.2	0.7—7.7 av. 3.5

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT

	Percentage Wasted in Preparing for Eating.	Percentage of Nutrients in Edible Parts.		
		Proteid.	Fat.	Carbohydrate.
PICKLES AND CONDIMENTS.				
Tomato catsup	......	1.1—2 av. 1.5	0.1—0.4 av. 0.2	8.5—16.1 av. 12.3
Horse radish	......	1.2—1.6 av. 1.4	0.1—0.2 av. 0.2	9.6—11.3 av. 10.5
Green olives	27	1.1	27.6	11.6
Ripe olives	19	1.7	25	4.3
Dried paprica	......	15.5	8.5	63
Red Chili peppers	......	8.2—11.1 av. 9.4	6.3—10.3 av. 7.7	67.3—72 av. 70
Cucumber pickles	......	0.4—0.7 av. 0 5	0.1—0.5 av. 0 3	1.3—5.4 av. 2.7
FRESH FRUITS.				
Apples	25	0.1—0 8 av. 0.4	0.1—1.4 av. 0.5	7 5—20.5 av. 13.2
Apricots	6	0 1	......	13.4
Bananas	35	1—1.6 av. 1.3	0—1.4 av. 0.6	15.5—29 av. 21
Blackberries	......	0.9—1.5 av. 1.3	0.5—2.9 av. 1	5—16. av. 8.4
Cherries	5	0 7—1.1 av. 1	0.8	11—20.5 av. 16.5
Cranberries	......	0.4—0.5 av. 0 4	0.4—0.9 av. 0.6	7.6—9.7 av. 8.4
Currants	......	1.5	0	12.8
Figs fresh	......	1.5	......	18.8
Grapes	25	1.3	1.6	15
Huckleberries	......	0.6	0.6	16.5
Lemons	30	0.5—0.6 av. 0.6	0.1—1.5 av. 0.7	7—8 av. 7.5
Muskmelons	50	0.6	0.	7.2
Nectarines	6.6	0.6	0	15.9
Oranges	27	0.8—1.1 av. 0.8	0.1—0.3 av. 0.2	11.6—18.5 av. 15.
Peaches	18	0.4—0.9 av. 0.7	0.1	5.8
Pears	10	0.3	0.1—0.8 av. 0.5	11.4
Persimmons	......	0.8	0.7	29

Pineapple	....	0.4	0.3	9.3
Plums	5	1	....	20
Pomegranates	....	1.5	1.6	16.8
Prunes	6	0.9	....	18
Red raspberries	....	1	....	9.7
Black raspberries	....	1.5—2.1 av. 1.7	up to 1.7 av. 1	11.7—13.6 av. 12.6
Strawberries	5	0.6—1.2 av. 1	0.4—1.1 av. 0.6	2.1—11.6 av. 6
Watermelons	60	0.1—0.2	0.1—0.2	6.5—6.9 av. 6.7
Whortleberries	....	0.5	3	11.3

(Note.—The U. S. Dept. of Agriculture is unable to explain the distinction between huckleberries and whortleberries, which are usually considered to be the same.)

DRIED FRUITS.

Apples	....	1.2—2.5 av. 1.6	0.1—5 av. 2.2	48.5—87 av. 66
Apricots	....	2.9—6.4 av. 4.7	1	62.5
Citron	....	0.5	0.6—2.5 av. 1.5	72.5—83.5 av. 78
Currants (Zante)	....	1—4.7 av. 2.4	0.4—4.7 av. 1.7	60—85.5 av. 74
Dates	10	2.1	0.6—5.1 av. 2.8	70.5—86.5 av. 78.5
Figs	....	2.6—5.7 av. 4.3	0.3	68—78.5 av. 74
Pears	....	2.8	5.4	73
Prunes	15	1.4—3.2 av. 2.1	....	68—78.5 av. 73.5
Raisins	10	2.3—3 av. 2.6	0.5—7.2 av. 3.3	71—79 av. 76

CANNED FRUITS, PRESERVES, ETC.—(As marketed, these are usually less saccharine than when home-made and the composition is variable. Most of the analyses showed 60—80% of water, the extremes being about 40 and 95%. None contained as much as 2% of "protein" and the fat varied from 0.1 to 2.4%, usually being less than 1%. The carbohydrates varied from 5 to 56% for preserves, usually from 15—25%. For jellies it should be about 75%.)

NUTS.

Almonds	45	16.6—25.3 av. 21	49—60 av. 55	10.5—20 av. 15.3
Beech	41	22	57.5	13
Biotes	35.5	8	37.5	48
Brazil	49.5	17	67	7

ORGANIC NUTRIENTS IN FOOD STUFFS. ATWATER AND BRYANT. CONDENSED BY A L BENEDICT.

	Percentage Wasted Mainly Shucks.	Percentage of Nutrients in Edible Parts.		
		Proteid.	Fat.	Carbohydrate.
NUTS.				
Butter	86.5	28	61	3.5
Chestnuts fresh	16	4.1—8 av. 6.2	2—10.8 av. 5.4	34.5—53.5 av. 40.3
" dried	24	8.2—13.5 av. 10.7	3.9—15.3 av. 7	62.7—78 av. 71.5
Cocoanuts	49 (shell and milk)	5.5	50.5	28
" milk (92.7 water)		0.4	1.5	4.6
" prepared		6—6.5 av. 6.3	51—63.7 av. 57.4	24.1—39 av. 31.5
Filberts	52	15.5	65.3	13
Hickory	62	15.5	67.5	11.5
Lichi	41.5	3	0.2	77.5
Peanuts	24.5	19.5—29.1 av. 25.8	32.3—48.8 av. 38.6	13.5—38.5 av. 22
Peanut butter		29.3	46.5	17.1
Pecans	50	10	71	14
Pine nuts Pignolia		34	49.5	6.5
Piniones	41.5	6.5	60.5	26
Pinon	40.5	14.5	62	17
Sabine	77	28	53.5	8.4
Pistachios		22.5	54	15
California walnuts		18.5	64.5	11.5
Black walnuts (California)		27.5	56.5	5.8—14.5 av. 10
Soft shell walnuts (California)	58	14.3—20.4 av. 16.6	60—67 av. 63.4	12—17 av. 13.5
"Malted nuts"		24	27.5	44
CHOCOLATE.				
Chocolate		13	48.5	30.5
Cocoa		21.5	29	37.5

CHAPTER XX.

Metric Units.

While it is advisable, in any scientific study, to form the habit of thinking in dexcimal units, the following table of approximate relations is given to allow those unfamiliar with the metric system to form a definite conception of the magnitudes expressed in grams, cubic centimeters, etc. It should be understood that the equations are merely approximate and cannot be used for the accurate translation of values.

Metric Weight Equivalents.

1 milligram = 1/1000 of a gram $\doteq$ 1/64 of a grain.

1 centigram = 1/100 of a gram = 1/6 of a grain (or minim)—$\frac{1}{3}$ of a drop of water.

1 decigram = 1/10 of a gram = $1\frac{1}{2}$ grains (or minims.)

[The dekagram and hektogram units, like the eagle in our currency, are not in common use; quantities up to a kilogram are read in grams.]

1 kilogram (commonly abbreviated and pronounced kilo) = 1000 grams = 2.2 pounds.

1 tonneau or metric ton = 1,000,000 grams = intermediate between short and long English Ton.

The gram is defined as the weight of a cubic centimeter of pure water at its point of greatest density, in vacuo. For practical purposes, temperature and atmospheric pressure may be disregarded and the gram and the cubic centimeter may be considered identical for all liquids of about the same density as water.

The same correspondence exists for the milligram and cubic millimeter.

1 grain = 6½ centigrams.
1 drachm = 3.9 grams.
1 ounce (Troy or Apothecary's) = 31.1 grams.
1 ounce Avoirdupois = 28.35 grams.
1 pound (Troy or Apothecary's) = 373.23 grams.
1 pound Avoirdupois = 453.6 grams.

Metric Linear Equivalents.

For practical, scientific purposes, only five linear metric units are in use:
1 micron or micro-millimeter = 1/1000 of a millimeter = 1/25,000 of an inch.

This unit is used in measuring microscopic objects and is about 1–7 of the diameter of an average human red blood corpuscle.

1 millimeter = 1/1000 of a meter = 1/25 of an inch.
1 centimeter = 1/100 of a meter = 2/5 of an inch.
1 inch = 2.54 centimeters.
1 foot = 30.48 centimeters.
1 meter = about 40 inches.
1 kilometer = 1000 meters = 5/8 of a mile.

Metric Surface Equivalents.

While a table of units of surface exists in theory, for practical scientific purposes, areas are expressed in squares of the various linear units.

Metric Volume Equivalents.

The unit of volume is the Liter, or cubic decimeter, equivalent to 1000 cubic centimeters.

The Kiloliter, or liquid ton, is a cubic meter; a Kiloliter of pure water at its greatest density, in vacuo, weighs 1 metric ton or 1000 kilograms.

For practical scientific purposes, the theoretic fractional and multiple units indicated by the prefixes mili-, centi-, deci-, deka-, hecto-, kilo-, are not employed but volume is expressed in cubic millimeters, centimeters, and meters. Even the term Liter is not always used but is expressed in cubic centimeters, commonly abbreviated and pronounced c.c. As a matter of convenience, the equations between English and metric units of volume, are given in reverse order to those of weight.

1 drop = 0.03 of a c.c.
1 minim = 0.06 of a c.c.
1 fluid drachm = 3.75 c.c.

(An old teaspoon contains about 4 c.c., a new one about 5 c.c., a coffee-spoon about 1 c.c., a dessert spoon about 10 c.c. a table-spoon about 15 c.c.)

1 fluid ounce (apothecary's) = 30 c.c.

(While the correspondence between metric measures of volume and weight, expressed in terms of water, is mathematically exact, a similar correspondence between the various English measures is only approximate. For example, the apothecary's fluid ounce equals 29.57 c.c., while the same ounce by weight equals 31.10 grams. The ounce avoirdupois equals only 28.35 grams.)

1 pint = 475 c.c. (more exactly 473.11 c.c.)

(A pound, apothecary's measure, equals 373.23 grams. 16 ounces, apothecary's measure, equal 497.60 grams; a pound avoirdupois equals 453.60 grams.)

1 quart = 946 c.c.—considerably less than a liter.
1 gallon = 3785 c.c.

CHAPTER XXI.

PRINCIPLES OF DIETETICS ACCORDING TO GENERAL PATHOLOGIC CONDITIONS.

Starvation.—This condition is rare in civilized communities, especially from outright deprivation of food. In such extreme cases, life may be maintained up to a limit of about 40 days, if there is no deprivation of water and no exposure to cold.

During starvation, the tissues are exhausted in order inverse to their functional importance. Sugar and glycogen are used up within a few days, though sugar may subsequently be formed from proteid. Fat is almost entirely exhausted, only about 1% remaining. However, in certain pathologic cases, there is interference with the oxidation of fat so that the patient dies, virtually from lack of the ability of performing the various metabolic processes, while a relative excess of fat remains. The bones, cartilages and dense fibrous tissues are almost entirely untouched and so also, are the heart and brain, during starvation, while the muscles and various glands are atrophied to a degree approximately corresponding to the ability of the body to spare their function.

If water as well as food is withheld, death occurs in about a week.

In the treatment of cases of starvation, great care must be taken not to give an abundance of food at once. Beginning with broths in small quantities, at intervals of one to two hours, small quantities of peptonized milk may be given; cereals may be added during the second day and anything like a full ration should not be given for four or five days. Meantime, hypodermoclysis and rectal injection of hot saline solution may be used.

While achylia gastrica does not, of itself, interfere materially with general nutrition, a similar condition involving the pancreatic and intestinal digestion necessarily causes death from the same

essential condition as gross starvation. This occurs in some cases of Addison's disease.

Starvation also occurs in impermeable stenosis of the oesophagus, pylorus, upper bowel, congenital or acquired, unless a fistula is established. It is significant that nutriment introduced into the stomach and predigested or assisted with digestants and with lavage but which cannot pass through the pylorus, or nutriment introduced into the rectum, does not materially lengthen the duration of life. In other words, if food cannot pass through a considerable portion of the small intestine, death is to be expected within forty days. Starvation also occurs within the same limit, if half or thereabouts of the small intestine is resected. About one meter of the small intestine may be resected with impunity, barring surgical accidents, but the resection of two meters, or about a third, is likely to result in gradual inanition. Serious disease or short-circuiting of corresponding lengths, produces approximately the same results.

Overfeeding and various related conditions will be discussed under diseases of metabolism.

Hyperaemia, Anaemia, Infarction, Thrombosis, etc., are not directly influenced by diet either etiologically or therapeutically, except in ways discussed under various other headings.

Atrophy and Hypertrophy depend to some degree upon food supply but, more particularly upon the functional usefulness of the part affected. Thus, the heart or other muscle or any part not of too great density, such as teeth, bones, fibrous tissue etc., which is, for any reason, in a state of disuse, tends to atrophy and, with similar qualifications, any part of which excessive function is demanded, as the heart muscle when the valves are crippled, the voluntary muscles under increased use, a kidney after the extirpation of its mate, tends to hypertrophy, without much regard to diet.

Thus, increase of food without exercise does not cause hypertrophy of muscle, etc., nor, providing enough food is taken so that increased function is not prevented by general lack of strength, does deficient nourishment prevent hypertrophy.

However, it is advisable that the diet should correspond to the functional activity of the body, mainly that of its muscles.

Any marked change in muscular activity should be gradual. The special danger of athletics is that they produce a physiologic hypertrophy of the heart which is beyond the requirements of the body for subsequent business or professional life and the subsequent adjustment by atrophy is slow and often attended by unpleasant consequences.

Degenerations. The various pathologic degenerations unquestionably depend to some degree upon disturbances of nutrition, though not very directly upon diet. Neither are they amenable to dietetic treatment to any great degree, although in most of them, a fairly liberal diet is indicated.

Necrosis, certain fatty degenerations, fibroid change and calcification, the last being almost invariably if not always secondary to fatty degeneration, through the intemediation of a saponification, are, however, pretty directly dependent upon local lack of nutriment, in which vascular degeneration plays an important part. It has been established by animal experiment that indican and other products of intestinal putrefaction, not only cause fibroid changes in the liver but in the vessels as well as in the kidneys. Thus, a chronic dyspepsia, originally trivial and functional, ultimately leads to the most serious results. Undoubtedly too, badly balanced, insufficient and excessive dietaries, long continued, lead to the same results.

Fibroid change is, to some degree, inevitable with advancing years. It may be delayed by careful diet, making sure that the average ration conforms approximately to the standard, and avoiding gross excesses of diet. The repeated stimulation of heart and arteries by tea and coffee or the alternate constriction by their active principles and relaxation by alcohol or tobacco or both, also, unquestionably tends to such changes. Since such changes are relatively frequent in women, who do not so generally have the latter vices, it seems probable that tea and coffee are in the long run more dangerous, providing the alcohol and tobacco habits are moderately indulged. Purin derivatives include xan-

thin, which is closely related chemically and in its toxic action to theine or caffeine and to theobromine which last is rarely indulged in to any great extent. Hence continued indulgence in purin and nuclein-containing foods is a further factor in producing fibroid degeneration.

The tendency to fibroid change once established, vicious cycles are established and there is a further tendency to fatty, saponaceous and ultimately calcareous change. After forty, lime should be taken in as small quantities as possible. Hard water, including various mineral waters supposed to have a miraculous action on the liver and bowels, is a factor of some importance. It is practically impossible to avoid lime in any diet, especially in the vegetable foods which should be so important a part of the diet of later adult life.

The author has found of apparent value in the declining years of life, a mixture of salts, approximating those of the blood, omitting lime and distributing the acid radicles between sodium and potassium. With this modification, there are in each liter of blood plasma:

Sodium chlorid	5.54 grams
Sodium phosphate	.50
Potassium chlorid	.36
Potassium sulphate	.28

The sulphates and phosphates tend to precipitate the lime present in the food. Water with this strength of mineral ingredients has an unpleasantly salty taste but it may be further diluted or the mixed salt may be used instead of ordinary table salt. Probably, if a liberal diet is taken, it is better to omit the potassium salts altogether, to prevent an excess of this element. Thus, the mixture may still further be modified as follows:

Sodium chlorid	6.00 grams
Sodium phosphate	.50
Sodium sulphate	.25

given daily in place of table salt.

Inflammations. In general, the diet appropriate to acute and subacute inflammations is described under the heading of fever. Chronic inflammation as related to diet is discussed under the heading of degenerations, and the special consideration of such viscera as the liver, kidney etc. Inflammation includes cloudy swelling and, etiologically, many of the degenerations.

Tumors.

There are no general dietetic indications in tumors.

General lipomatosis is, possibly, due to the same causes as obesity and may possibly be improved by the same line of diet. Discrete lipomata are not thus influenced.

Cancer has been variously ascribed to an excessive meat diet, to excessive use of salt, to conveyance of a supposititious parasite by raw vegetables and to the ingestion of embryonic cells as in raw eggs. None of these contradictory hypotheses is substantiated.

The diet is an important factor in many cases of tumor located in the alimentary canal and such tumors are usually cancerous. However the dietetic problems depend upon mechanic factors, the presence of ulceration etc. and not upon the neoplasm itself. They will, therefore, be discussed under local headings.

CHAPTER XXII.

INFANT FEEDING.

There is no nourishment for an infant equal to the milk of a normal mother. BUT, almost any kind of artificial food is better than the milk of a woman with tuberculosis, acute febrile disease, nephritis, local sepsis of the breast (unless there is an adequate supply from the sound breast), chronic intestinal putrefaction, marked anæmia, etc.

Even sudden emotions, such as fright, grief, anger etc., are liable to render the milk toxic, and lactation should be suspended for several hours.

A wet nurse is theoretically the best substitute for an incompetent mother but should not be employed unless the physician can mutually guarantee nurse and nursling against tuberculous, syphilitic and other infections, nor unless the wet nurse is conscientious. The ethics of sacrificing the interests of the nurse's child should also be weighed.

Aside from infections, the principal dangers to be apprehended from a wet nurse are inadequacy of the milk supply, especially if she continues to nurse her own baby; indiscretions in diet to which there is special predisposition on account of the sudden transition to surroundings of relative luxury; indiscretions in drink, including the use of beer as a galactagogue; irregularity in feeding, either from carelessness or the pernicious use of the breast to quiet crying; the use of opiates or sexual manipulations to quiet the child.

Preparations for the baby's diet should begin early in pregnancy. The mother should be well nourished and kept free from auto-intoxications of all kinds; the nipples should be kept scrupulously clean and, if necessary, everted; moral suasion to induce the mother to nurse the child may be necessary.

The secretion of milk is usually well established within two or three days after labor. Even before the secretion is established, the child should be put to the breast regularly, to stimulate

uterine contractions, to stimulate the secretion of milk, for the sake of the laxative action of the colostrum, and to establish proper habits in mother and child.

Before the flow of milk is established, the child should not be given teas or syrups of any kind, but boiled water should be given occasionally.

Every nurse and mother should be taught that the breast is not a plaything with which to amuse the child, a hypnotic, a source of liquid with which to quench thirst but that it is solely a source of nourishment.

The mother who nurses her child every time it cries is doing her best to make it a life-long dyspeptic.

It is even more important that the infant should have its meals regularly than that the adult should.

The minimum period between nursings should be two hours.

Up to about the middle of the second month, the interval between feedings should be 2—2½ hours; to the sixth month 3 hours; to the ninth month 3½ hours; thereafter 4 hours; in each case with a double interval at night.

Weaning should occur at about the tenth or twelfth month, anticipating or delaying so as to avoid a change of diet during hot weather. As early as the seventh month, the baby may be allowed to suck a bone, a piece of steak or of good salt pork, once a day, taking care that it does not swallow or choke upon it. Weaning should begin with the substitution of artificial feeding once a day and should occupy two months altogether. If trouble ensues, full breast feeding should be resumed for a week or two before making a second attempt—providing there is no emergency.

The various cow's milk preparations, to be described in cases of compulsory artificial feeding, may be used during weaning. After the baby is fully weaned, arrowroot, farina and other soft cereals, part of a soft boiled egg, beef juice, light soups, crackers and dry bread may be gradually added.

For the second year, five meals should be given daily, leaving twelve hours for uninterrupted sleep.

For the normal breast-fed infant, the dose of milk is a stomachful. The organ being relatively small and strong walled, if too

much is taken, the baby pukes, that is to say, it spills out the excess, the process being entirely different from vomiting.

Unless there is hare-lip, cleft palate, tongue-tie, etc., 15—20 minutes suffice for a nursing. The infant should no more be allowed to spend an unreasonable time in nursing and playing with the breast, than an older child should be allowed to dawdle at the table and play with its food.

Artificial feeding, well carried out, is superior to nursing by an unhealthy mother or an unreliable wet nurse.

Modified cow's milk is, on the whole, considering expense, availability and the possibilities of hygienic control, the most convenient and the best substitute for maternal milk.

By weighing infants, before and after nursing, and by analyzing maternal milk, the following theoretic, average basis for artificial feeding has been established: (Holt, Rotch and others agreeing closely.)

Age.	Number of feedings.	Ounces at a feeding.
Two weeks.	8	2
One month.	8	3
Two months.	7	4
Four months.	6	5
Six months.	6	5½—6
Nine months.	5	7 —7½
Twelve months.	5	8 —9

The amounts are left in ounces as the figures, multiplied by two are then readily converted into tablespoonfuls.

The use of one cow's milk is like putting all one's eggs into one basket. There are fewer things to watch but those that remain must be watched all the more carefully. Mixed milk is more likely to conform to average standards and, while a greater number of chances of accidental infection are present, the infection, if present, will be more dilute and less virulent.

Percentage modification of milk should not be made a fetich. It is rational to approach as nearly as possible to the proportions of human milk, but human milk varies considerably without harm to the child and the differences in the exact nature of the

proteids, size and consistence of curds after the action of rennet ferment, and differences in antitoxic and analogous substances, are of more importance than differences in percentage composition.

Wherever a reliable milk laboratory is available, the simplest and best method is to write a prescription for modified milk, according to the table, and to have the requisite amount for each feeding dispensed in a separate bottle.

The table below shows the average percentages employed by 117 physicians for the feeding of 224 healthy infants.

The percentages are given in the round numbers nearest the actual percentages employed, and are approximate.

THEORETIC BASIS FOR FEEDING A HEALTHY INFANT.

	Age.	Gastric Cap'ty	Prescription. Per Ct. Fat.	Per Ct. Milk Sugar.	Per Ct. Proteids.
Premature infant...	—	Drams 2–6	1.00	3.00	0.20
			1.00	4.00	0.50
			1.50	4.50	0.75
Birth at term...	Hrs. 24–36	Oz. 1	5 per cent Solution Milk Sugar, Distilled Water.		
			Fat.	Milk Sugar.	Proteids.
1st Week...		1	2.00	5.00	0.75
2d Week.....		1½	2.50	6.00	1.00
3d Week....		2	3.00	6.00	1.00
4th to 6th.....		2½—3	3.50	6.50	1.00
6th to 8th.......		3 —3¼	3.50	6.50	1.50
8th to 16th......		3¼—4½	4.00	7.00	1.50
16th to 24th....		4½—5¾	4.00	7.00	2.00
24th to 32d.		5¾—7	4.00	7.00	2.00
32d to 36th.		7	4.00	7.00	2.25
36th to 40th...		7 —8	4.00	6.50	2.50
40th to 44th....		8 —8½	4.00	5.00	3.00
44th to 48th.....		8½	4.00	4.50	3.50
48th to 52d.....		9	4.00	4.50	4.00

NOTE.—The percentages given above may be considered slightly high for the average, as they represent only the modifications employed for perfectly healthy infants.

As the composition of human milk does not vary regularly to any great degree, after the secretion has become well established, and as the variations in any one case may exceed the difference between the theoretic normal standard for any one time and an average artificial imitation of human milk, we may adopt a single formula in the absence of a reliable milk laboratory. The following prescription may be taken as a basis for a single day's ratilon:

Milk...	422 c.c.
Cream.	80 c.c.
Physiologic salt solution, up to...	900 c.c.
Lactose in powder.....	46 grams.

About $\frac{1}{3}$ of this total amount will be required for the first week, $\frac{1}{2}$ in the second and third weeks, about $1\frac{1}{3}$ for the last month or so before weaning.

Various dippers, graduated bottles etc., may be used for combining ordinary milk, top milk (the upper part of milk that has stood 3—4 hours or more), cream, water, lactose etc. The choice among these methods must be made according to the authority of the proposer. Most are fairly accurate, if the directions are followed carefully.

Thompson advises using the top fifth of milk that has stood in an ordinary quart bottle, 1 part; water (better physiologic salt solution), 2 parts, and adding to every four ounces of the mixture a heaping teaspoonful of milk sugar.

Holt advises the use of equal parts of ordinary fresh milk (shaken if the cream has begun to rise) and cream (containing 25% of fats), and, to each part of the mixture, adds four parts of water (salt solution preferred), and lactose as in Thompson's mixture.

Top milk and, a fortiori, true cream, contains much more fat than milk and only a trifle less proteid. The addition of water or salt solution, including sodium citrate which is at present in vogue, lime water etc., reduces the proportion of fat and proteid to about that in human milk but also reduces the lactose much below the normal standard. By dilution, the coagulation occurs in smaller masses than usual for cow's milk, thus approaching the curds of human milk.

Various mucilaginous diluents may be employed for the same purpose: ordinary gelatin, Iceland moss, Irish moss, agar, acacia, barley, oatmeal and other cereals in water. All should be freshly prepared by boiling. For example, we may use

Top milk, ½ pint
Barley water, 1 pint
Lactose, 6 heaping teaspoonfuls.

This amount is about sufficient for a day, during the second month.

After the seventh month, we may substitute:

Top milk (or Holt's mixture of equal parts of milk and cream)	19 oz
Barley water	19 oz
Lactose	6 heaping teaspoonfuls

Algebraic Computation of Artificial Milk.

When canned or condensed milk and cream are alone available or when we wish to imitate the methods of milk laboratories, the following formulae may be used (Author's method, with assistance of Prof. M. M. Wardwell).

$$x = \frac{pf'' - fp''}{p'f'' - f'p''}\, a.$$

$$y = \frac{fp' - f'p}{p'f'' - f'p''}\, a.$$

$$w = a - (x + y)$$

In these equations, a is the number of c.c. (or other units) of the modified milk mixture, desired for a feeding or for a day.

x is the number of units of milk containing approximately the same proportionate ingredients as ordinary cow's milk.

y is the number of units of cream.

w is the number of units of water.

p, f, and l, represent grams per hundred of proteid, fat and lactose. Without primes they indicate the percentages in the desired mixture; with single primes, the same for milk; with seconds, the same for cream. To determine the amount of lactose to be added, we have the equation:

$$z = la - (l' x + l'' y)$$

If it is desired to be very accurate, all quantities may be estimated by weight (grams instead of c.c.) and, in this case, the equation for water becomes $w = a - (x + y + z)$

Note that in this, as all cases in which a correspondence between units of weight and of volume is assumed, there is no exact correspondence between the volumetric and gravimetric drachm, and ounce or between the pint and pound.

Human milk is persistently though faintly alkaline, while cow's milk is usually feebly acid. The former has a slightly higher specific gravity (1031.3 as against 1029.7 for cow's milk) and slightly more solids (13.33% as against 12.61). Human milk sucked from the breast is sterile or nearly so while it is practically impossible, with all precautions, to deliver cow's milk with less than 10,000 bacteria per c.c. Hygienic dairies frequently deliver milk containing 40,000 bacteria per c.c. and 100,000 is about the best result to be expected from commercial dairies. Even this number, consisting mainly of comparatively harmless saprophytes, usually produces no trouble. 1,000,000 bacteria are often found in a c.c. of ordinary commercial milk.

Dairy milk should contain about 3.75% of fat, human milk 4.13%. The respective proteid composition is 3.76% and 2%; lactose 4.42 and 7%; ash 0.68 and 0.2%. Good cream contains 3.5% proteid, 25% of fat (20% is the more common commercial average) and 3.5% of lactose. These percentages may be used in the algebraic computation of artificial milk mixtures.

Sterilization and Pasteurization.

If milk can be obtained under conditions of thorough cleanliness, immediately cooled and placed in sealed bottles and delivered

within 12 hours, it is, on the whole, better for infant feeding than milk antiseptically treated.

Sterilization—assuming the absence of spores of tubercle bacilli, tetanus bacilli and a few other extremely resistant germs—is accomplished by subjecting milk for ten or twelve minutes to a boiling temperature. The bottles and cotton stoppers should first be sterilized by dry heat, as in an oven, at the same temperature, for half an hour or so. Sterilization destroys the amylolytic ferment of milk, which may be dispensed with, it renders more difficult the coagulation and digestion of the casein and, of course, coagulates the lactalbumin. The fat coalesces so as to become less readily absorbable. Lactose, by prolonged boiling, is more or less converted into monosaccharids, which probably does no harm, since it is virtually a predigestion. Antitoxic and antiscorbutic substances are destroyed. Thus, except for the destruction of bacteria, sterilized milk is distinctly less valuable than fresh milk.

Pasteurized milk is a compromise between fresh and sterilized milk. The process is the same except that the temperature used is 160—170 Fahrenheit, instead of boiling point. The lower temperature will destroy practically all of the germs accidentally introduced and most of the tubercle bacilli, if any are present. The untoward changes produced by sterilization are not so pronounced.

The choice between fresh milk, sterilized and Pasteurized milk must be made according to circumstances.

Budde process of sterilizing milk. To one liter of milk, obtained as clean as possible, 15 c.c. of hydrogen peroxid solution is added. The milk is then heated to 51—52 centigrade (124 F.) for three or four hours. This destroys the hydrogen peroxid and the nascent oxygen liberated, kills the bacteria. Milk thus treated keeps for about ten days—though it should not be kept if used for infant feeding.

Formaldehyde and other preservatives should not be allowed in milk.

In all cases, the child's lips, tongue and mouth and the breasts of the mother, should be kept decently clean and borax solutions

followed by pure water, recently boiled, should be used before and after feeding. Short rubber nipples, not long tubes, should be employed on nursing bottles and both bottle and nipple should be thoroughly cleaned and sterilized before using. The milk should be kept in sealed bottles, on ice, until just before using, and not more than one day's supply should be prepared at once.

For traveling or when there is suspicion of the milk supply or actual danger of specific infection, as during an epidemic of scarlet fever, typhoid etc., sterilization should be practiced.

Goat's or sheep's milk may be used for infants that do not thrive on cow's milk.

Buttermilk freshly soured, not that which has accumulated for several days before churning, may occasionally be used for infant feeding. It contains about 2.5% of proteid, ½—1% of fat and 3—3.5% of lactose. It should not have an acidity of over 70% with decinormal alkali and phenolphthalein, but commercial buttermilk usually has an acidity of 90—95%. It should not be used continuously, on account of the lack of fat. Lactose may be added in equal amount to that contained in the buttermilk, to bring it up to the required standard.

One white of egg contains almost exactly the amount of proteid required in a day by a child in the first week; two for the fourth week; three for the third month; four for the last three months of the first year. Thus albumin water may be used as an emergent ration and lactose and even cream may be added.

Meat juice and certain extracts contain about three times the percentage of proteid in human milk. Thus, for furnishing proteid, one third of the standard amount of breast milk may be given. They should not be used continuously. Lactose and cream may be added, unless, as in many summer complaints, fevers etc., it is thought best to suspend these forms of food.

Various proprietary foods, condensed milk etc., may be used for infant feeding in emergency.

Do not use a proprietary food unless its composition is attested by impartial and reliable authority.

Do not use foods containing any appreciable quantity of starch until after the sixth month. Amylolytic ferments may

be present before this time, or their development in sufficient strength may be delayed.

Remember that magazine advertisements critically inspected are a good criterion of the merits of a food. These usually show a fat, soft, flabby infant.

A reasonably well nourished child can, in case of diarrhoea or acute febrile disorder, get along very well for three or four days without nourishment. Saline solutions may be used to relieve thirst. If the principal element in the fever is the fermentation and putrefaction of milk or other food in the alimentary canal, it is far better not to try to administer organic food of any kind for a few days, unless the baby is critically weak.

In any case, whether in infant or adult, the proper amount of salines may be administered by following the composition of the blood.

The author's formula, modified from Schmidt is as follows:

Sodium chlorid	5.54 grams
Sodium phosphate	.27
Potassium chlorid	.36
Potassium sulphate	.28
Calcium phosphate	.30
Magnesium phosphate	.22

to be added to 1 liter of distilled water.

This solution may be used in preparing milk modifications.

In haemorrhagic conditions, gelatin solutions may be used to advantage in diluting cow's milk. If there is the least suspicion of infantile scurvy, use orange juice or fruit jelly dissolved in water. A few teaspoonfuls of unsweetened orangeade etc., should be given daily whenever the baby is fed artificial or sterilized foods. Boil the gelatin thoroughly to insure against internal anthrax infection and be sure that it is really animal gelatin and not a vegetable mucilage.

Do not forget that the infant, like the adult, can not digest well if fatigued or nervous or suffering from intestinal or other auto-intoxication. The young child should spend practically all its

time in nursing and sleeping. Even after three or four months, it should not be tickled, played with, rocked and mauled but should be allowed to play quietly. Avoid exposure to bright sunlight unless the eyes are protected. Keep the child out doors as much as possible but avoid too inclement weather. The child should be dressed so as to avoid cold and dampness, including dampness due to urine and saliva but, on the other hand, many children are too warmly dressed. If the child's body and clothing are habitually wet with sweat, it indicates either some serious disturbance or too warm clothing.

Marasmus is a term often loosely employed to indicate any conspicuous failure of nutrition, including tuberculosis. It should probably be applied to an intrinsic failure to assimilate proteids due to a hypothetic lack of power properly to disintegrate and recombine the proteid molecule or to the presence of precipitins against foreign proteids. On either hypothesis, there is substantial agreement with the clinical observation that a true marasmus is practically limited to artificially reared infants. If a return to breast feeding is impossible, it may suffice to secure the occasional services of a wet nurse, or to convey human milk from some mother who has an excess. Even a partial ration of human milk may restore the power to assimilate other milk. Marasmus may, however, consist in a condition analogous to achylia totalis of adults and in such cases, which are mainly limited to premature infants, nutrition may fail even with an abundant supply of normal maternal milk.

If the supplying of human milk is impossible or if it fails, various changes of diet and attention to digestion may be tried, but the prognosis is rather unfavorable.

Pyloric hypertrophy and obstruction occurs without discoverable cause in certain infants, although it is probable that, since attention has been called to this condition, the diagnosis has sometimes been made without proper foundation. Obstinate vomiting of practically all of the ingesta, resulting constipation and relative absence of faecal contents except those due to elimination from the tributary glands and the intestine itself, with loss of weight and obvious malnutrition, establish the diagnosis of

some form of alimentary obstruction and if this cannot be promptly relieved by careful diet and lavage, operation should be performed.

The same indications of obstruction, manifest from birth and absolute, point to the existence of an anomalous lack of patency somewhere along the alimentary canal, usually just below the pylorus or near the anus, on account of embryologic development. In imperforate anus and rectum the signs are limited to lack of evacuation and abdominal distention.

Of post natal forms of alimentary obstruction, intussusceptio is the commonest in infants and young children and, indeed, is so frequenly found at necropsies as to suggest that it may almost be considered a normal condition, becoming pathologic only when the bowel does not spontaneously extricate itself.

Teething.

Teething, like the establishment of menstruation, the menopause etc., is a perfectly normal period but liable to react upon the general health and digestive power so as to produce serious disturbance.

The deciduous teeth consist of 5 in each lateral half of each jaw, 2 incisors, 1 canine and 2 molars (corresponding to the permanent bicuspids). The exact order of appearance is quite variable but is about as follows, the lower teeth usually appearing before the upper and the lateral pairs normally at the same time:

Lower central incisors	6— 9th month
Upper central and lateral incisors	8—10th month
Lower lateral incisors and first molars	15—21st month
Canines	16—20th month
Second molars	20—30th month

The permanent teeth appear as follows:

First molars (6th tooth from center in each half of each jaw)	6th year
Central incisors	7th year
Lateral incisors	8th year

First bicuspids (replacing first deciduous molars).....10th year
Second bicuspids (replacing second deciduous molars)...11th year
Canines...... ....12—13th year
Second molars (7th tooth from center in each half of
each jaw)......................................12—15th year
Third molars ("wisdom teeth", 8th from center) .17—21st year

often not appearing till 30th year and sometimes not till later or not developing fully.

By using teething rings, preferably of non-toxic rubber, and by carefully lancing the gum or pushing it aside with an ivory instrument, much of the reflex discomfort of teething may be avoided. Most of the serious disturbances ascribed to teething are due to careless methods of feeding and, especially to the development of bacteria in the food. As teething is pretty continuously in process after the fourth month, till long after weaning is accomplished, the applicability of the term to a disturbance of digestion is usually conspicuous by its absence.

CHAPTER XXIII.

DIET IN CRITICAL PHYSIOLOGIC PERIODS.

According to Atwater, the child in the second year of life, though weighing only a fifth or sixth as much as the adult, requires 3/10 of the standard adult ration, the relative excess being due to the fact that the child is rapidly depositing tissues, including fat. From the third to the fifth years, about 4/10 of the adult ration is required; from the sixth to the ninth years, 5/10; from the tenth to the thirteenth years, 6/10. Thereafter, there is a difference in habits of life so that the girl from 14 to 16, requires 7/10 of the adult ration; the boy 8/10. After this age continued growth and relative activity compensate for any average difference in weight between the youth and the adult. The adult woman requires 8/10 or 9/10 the ration of a man in the same walk of life. After the age of thirty, there is a gradual diminution of the dietetic need, and in old age, many individuals eat only about half the standard ration for an adult.

M. Allen Starr's Table of Dietetic Needs in Childhood.

	2—3 years. (28 cases).	3—6 years. (12 cases).	4—10 years. (24 cases.)
Bread. . . .	7.5 ounces.	10.3 ounces.	10.23 ounces.
Butter.	.98	1.08	.99
Beef.	4.6	12.1	12.46
Potatoes.	3.9	Rice 13.	10.23
Milk.	32.6	48.6	38.5

(Above determined from actual consumption by groups of healthy children.)

Late Infancy.

At the close of weaning, at about the beginning of the second year of life, the child should be taking five meals daily, arranged about as follows:

7, 10 A. M., nap, 1, 4 P. M., nap, 7 P. M., night's sleep.

A hint as to the nature of the diet may be obtained from glancing at the table of dentition on page 208. During the second year, the child has good incisors but the canines and first molars (fourth teeth from center) are not in commission till the middle of the year and the second molars not until about the end of the year.

On account of the dentition, the child should not, in the most literal sense, bite off more than it can chew. There are also purely chemic reasons for restricting the diet mainly to milk, eggs and cereals, including various preparations of wheat flour, such as bread, crackers, light sugar and ginger cookies etc. Only enough meat should be allowed to furnish haemoglobin, say 25—50 grams a day. The child should also reject the fiber after mastication and sucking of the juice. Soft, pulpy fruits, such as oranges, apples (especially baked) should be given as dessert, and a little sugar candy and simple puddings may also be allowed. The various condiments, table beverages, and complicated dishes should be interdicted. Some children crave and thrive upon bananas, and although these are not digested till the intestine is reached, they are nourishing, mainly by furnishing starch and sugar, but also a little proteid. Milk or cream may be poured over the slices.

It is not only cruel but physiologically absurd to make a young child swallow gristle, tough meat, coarse vegetables, pie crust etc., and it is advisable not to urge too strongly the use of yolk of egg, fat meat, bread crusts, or other articles to which the child objects.

Early Childhood (Third to Sixth Year, Before School.)

The meals should be four in number, and one nap a day, usually in the afternoon, will suffice in most cases after the fourth

year. There is to be no sudden change of diet, but the proportion of milk will gradually be decreased and the mushy cereals will give place to greater and greater proportions of bread stuffs, cookies etc. Butter will be eaten in correspondingly greater quantity, and a little more meat will be eaten. The range of fruits will be extended, desserts need not be so closely restricted and a greater variety of vegetables will be allowed, though the "fodder" vegetables should be allowed only in small quantities and should not be pushed contrary to the child's appetite, as they are never of any great value.

The first permanent molars appear towards the close of this period, while the deciduous incisors begin to decay, so that many children present an opposite condition to that of late infancy, and require preparation of food by fine cutting, scraping etc.

The habit of cleaning the teeth with thread and brush, using borax water with or without good soap, should be formed early in life and dentistry should be called in to assist in the preservation even of the deciduous teeth, by means of soft fillings. Not only are the deciduous teeth valuable in themselves, but the colonization of bacteria of caries in them ultimately tends to early loss of the permanent teeth.

Childhood From the Beginning of School Life to Puberty.

At about the beginning of the sixth year, the formal education of the child begins. While in a sense, school life is artificial, there should be no mawkish sympathy for the child or feeling that health of body is necessarily sacrificed to growth of intellect. Intellectual exercise has a hygienic value very similar to that of physical exercise and the regular habits and occupation of time and awakening of interest, are beneficial. School houses, as now commonly built in progressive cities, and even in the country, correspond fairly well in hygienic and sanitary advantages, to the average home and are far superior to the homes of the proletariat or to the streets.

A child that cannot easily and without physical detriment, keep up with his classes, is defective. The defect may be due to imperfect vision or hearing, to sluggish respiratory changes due to

adenoids etc., to imperfect nutrition at home, or to some other remediable condition that is more likely to be detected by regular school inspection than by the observation of ignorant and careless parents. Or it may be due to some irremediable physical defect or disease, rendering it useless to attempt to educate the child. Otherwise it is due to some mental or moral defect requiring special means of instruction.

During the school period, the child will usually take three meals a day, beside a light lunch in the middle of the morning.

Special vigilance should be used to avoid the effects of irregular eating and drinking of various articles not on the bill of fare; the influence of badly disciplined associates being an important item.

Parents should consider it their duty so to order the meals of the household and the life of the child outside of school hours, that he may eat regularly and leisurely, without fear of discipline on account of tardiness. It is advisable that the child should, if possible, attend a school near enough to allow a warm, hearty, mid-day meal.

Per contra, educators should see that the hygienic condition of the school is such as to favor the work of the child without undue fatigue, or other factors that take away appetite and interfere with nutrition. They should not require an amount of study that the average child can not perform, for the most part, in school hours; should not visit the sins of the parents upon the child; nor impose discipline that overtaxes the child and interferes with his meal hours.

During this period, the child should eat the ordinary adult foods, subject to exclusion of beverages like tea, coffee and beer and of various articles that adults usually eat with impunity but which overtax the digestive powers of children. The meals should be so planned that the child can have warm food at noon and, on the other hand, he should not eat a full dinner at night.

Puberty and Early Adolescence—High School Period.

The single long session of most high schools, though most convenient for many reasons, is likely to impose too long and severe a strain on the boy or girl, especially if there is no appetite for a

hearty breakfast. Many persons can never advantageously eat dinner early in the morning and it is folly to attempt to enforce such a regimen. A sensible plan would be to arrange the high school instruction so that no pupil would be required to attend more than four consecutive periods. Otherwise, a long enough recess should be allowed for a light lunch in the middle of the morning.

Insufficient, hasty breakfasts and reliance on coffee, are often due to late hours in the evening, either on the part of the pupil or of the family generally, so that breakfast is not served at an hour suitable for him.

Social dissipation of high school pupils should be limited to Friday and Saturday evenings, during school sessions.

During the menstrual flow, girls should be excused—compulsorily, if need be—from school attendance, if there is any abnormality.

During the high school period, the mid-day meal should continue to be the main one, although, by proper choice of food, this need not interfere with the customary arrangement of luncheon and evening dinner for the family generally.

At about this time, the question of the allowance of tea, coffee, tobacco etc., is apt to arise. While abstinence is theoretically desirable, even for the adult, it is almost imperative for the adolescent if health is to be maintained. Weak cocoa affords an excellent substitute for tea and coffee. It should be impressed on the boy or girl that there are purely physical conditions during the period of growth, as well as differences in the business and social demands upon the adolescent and the adult, which render abstinence necessary in the former, and indulgence comparatively harmless in the latter. If the appeal to judgment based on these grounds, is not sufficient, parental discipline may be necessary and it is even worth considering whether the health of the youth is not worth the argument of example as well as precept. The prejudice against cigarettes, as compared with stronger forms of tobacco, is due almost entirely to their premature use by boys too young to tolerate tobacco in other forms.

Abstinence from alcoholic beverages should be insisted on until full adult age is reached.

Menstruation.

A thoroughly normal woman should not be treated as an invalid during menstruation, as regards diet or anything else, except that very hot or cold baths, excessive physical or mental strain etc., should be avoided.

Various menstrual disorders, especially during the first year or two, indicate rest, confinement to the bed or lounge, and a diet corresponding to the relative quiescence.

Anaemia, thyroid disturbance etc., depending on menstruation, require the appropriate diet for those conditions, q.v.

Pregnancy.

In the majority of instances, there are practically no symptoms of pregnancy excepting the skipping of the menstrual flow, till about the beginning of the third month.

Morning sickness, consisting in nausea and vomiting of a little mucus usually begins in the third or fourth month and persists for three or four months, more or less regularly. Through sympathy, sometimes even without the witnessing of the attack, the husband may similarly be affected. In the latter case, the trouble is purely neurotic.

As soon as pregnancy is positively diagnosed, the hygienic and dietetic care of the woman should begin. Not to mention distinctly pathologic states, it should be borne in mind that pregnancy is practically a disease, with definite etiology—which may even be said to consist in the invasion of a germ,—symptomatology, organic and functional disturbances, and even a pretty definite mortality of not far from 1%.

Every pregnancy involves an increased strain on the circulatory organs and upon most or all of the glands, both ductless and excretory, concerned in metabolism. Aside from the pelvic organs, the thyroid, heart, vessels, kidneys and liver are the principal organs threatened.

The specious stimulation and secondary depression of tea, coffee and alcoholics should be avoided. The vulnerability of the liver renders it at least doubtful whether the common use of beer and ale is advisable. Moderate indulgence in these various habits may be allowed.

The ordinary cases of morning sickness require no special dietetic restriction, but it must be remembered that so-called morning sickness may be merely the first stage of a true hyperemesis or an indication of (1) uterine incarceration or other serious local abnormality requiring mechanic or genuinely surgical interference or (2) that it may indicate serious metabolic disturbance:

a. of the thyroid;

b. of the liver;

c. of the kidneys;

d on account of local septic involvement of a dead foetus;

e. on account of alientary auto-intoxication;

f. (a fact usually ignored by obstetricians and gynaecologists) on account of purely local functional or organic digestive disturbance, to which the pregnancy is at most a predisposing or exacerbating factor.

Hence, the use of one drug after another in the treatment of morning sickness and, a fortiori, of genuine hyperemesis, is asinine.

The diet throughout pregnancy should be simple but fairly varied. Particular care should be taken to exclude the beverages already mentioned, large amounts of meat, especially canned goods, sea foods at a distance from the ocean, undrawn poultry, stale eggs etc., in which decomposition may have begun, and also liver, thymus, kidney etc., on account of extractive waste.

Cereals, milk, cream and butter, fresh eggs, small amounts of fresh meat, poultry, fish etc., leguminosae (pod vegetables), both kinds of potatoes and other vegetables comparatively rich in nutriment and containing little indigestible residue, soft fruits free from seeds, should be the mainstays of diet.

While it is important to secure daily passages of the bowels, peristalsis should not be stimulated by undue amounts of seedy fruits, fodder vegetables etc., which act as mechanic irritants, nor by malt liquors etc., which act by favoring fermentation. It is far better to use cascara, purpetrol and other medicinal laxatives or to secure evacuation by enemas or soap or glycerine suppositories.

While the weight of the child amounts to little, less than two pounds a month including the membranes, placenta and liquor amnii, allowance must be made for the metabolic changes in the foetus and for increased circulatory and other functions in the mother. Hence, the pregnant woman requires a more liberal diet than the non-pregnant. On the other hand, as violent exercise and hard labor are contraindicated, and as, during the last two or three months of pregnancy, the woman must be partially invalided, she is unable to care properly for foods that lay an extra strain on the digestive and eliminative organs.

It is advisable, if practicable, to check the quantity of nutriment ingested and the excretion of the nitrogenous waste, quite accurately. An excellent rule of thumb is that the nutriment should be sufficient to increase the weight quite regularly to the gross amount of two or three pounds a month.

Peculiar cravings should usually be gratified in moderation.

Any distinctly pathologic condition occurring during pregnancy, as anaemia, thyroid disturbance, renal insufficience or frank lesion, chorea etc., as well as diseases continued during pregnancy, require appropriate management which, in general, is not contraindicated by the pregnancy itself.

Labor.

During labor, it is usually unwise to attempt to force the patient to eat. On the other hand, hot coffee or chocolate with milk and sugar, egg nog with very little alcohol, may be given advantageously and there is no objection—unless anaesthesia is contemplated—to ordinary light diet at fairly regular intervals, including extra meals at night.

Puerperium.

Milk, eggs, cereals, small quantities of tender meats and very simple desserts should be given. The action of gelatin in controlling haemorrhage, should be remembered. Tea, coffee, alcoholics etc., should be interdicted on account of the influence on the milk, unless the indication is considered urgent.

Lactation.

There is no drug, including as a drug, beer and other alcoholic beverages, which is at once efficient and free from contraindications, as a galactagogue.

The only true galactagogue is good, nourishing food, including milk, not so much because it is milk, as because it is, on the whole, easily digested and assimilated and because it furnishes approximately the right proportion of solids and water needed in the secretion of the mammary glands.

It is scarcely necessary to state that ingested milk is not directly utilized in the formation of secreted milk.

Eggs, cereals, moderate quantities of meats and vegetables, fruits, sugar-containing foods; in short, a very liberal ordinary diet, restricted only with regard to definitely harmful ingredients, is appropriate to the nursing mother.

Most drugs having a systemic action are excreted to a greater or less degree through the milk. Strong tea, coffee and chocolate must be considered as drugs. Thus, unless there is special indication to medicate the suckling, as with laxatives, iodids, mercury etc., all drugs should be given with great caution during lactation. In cases in which it is absolutely necessary to administer opium alkaloids, atropine, bromids, or, in fact, any "strong" drug having an action on the nervous system, nursing should usually be discontinued and the child should be nourished artificially. If the medication is probably of short duration, the breasts should be regularly pumped out, to preserve their function. At least twenty-four and preferably forty-eight hours should be allowed

for elimination, after medication has been suspended. The same rule applies in cases of accidental poisoning.

All foods containing appreciable quantities of volatile substances such as onions, garlic, or of hypnotic substances, such as lettuce, hops, and hence, beer, or which tend to produce alimentary putrefaction, as tainted meats, or fermentation as coarse, fodder vegetables, or which contain notable quantities of oxalates, benzoates, purin bodies etc., should be discontinued or used in very small quantities during lactation.

It must not be forgotten that excessive physical strain, excitement and hence, social dissipation, is liable to interfere either with the general nutrition of the mother or with the functions of the breasts. Engagements which conflict with the times of nursing should be canceled and only urgent demand for recreation or important business should excuse the disgusting custom of nursing in public or the infliction of a small baby on public gatherings, to say nothing of the excitement and exposure of the child itself.

Menopause.

An important element in the management of women at the change of life is to impress upon them the fact that they have no definite disease, but are undergoing a perfectly normal cessation of function, and that, while there are likely to be minor disturbances of physical and psychic processes, these do not require any special regulation of diet and do not excuse hysteric outbursts.

On the other hand, if a woman at the menopause manifests distinct pathologic symptoms, she must be examined and appropriately treated.

Aside from avoiding dietetic excesses and irregularities and taking some palns to prepare the food so as to appeal to the appetite, no special modification is necessary.

The use of ovarian extracts after or during the menopause, is of doubtful propriety, as there is normally a deprivation of ovarian function.

However, it must not be forgotten that certain diseases tend especially to develop at the menopause. Among those requiring

dietetic treatment may be mentioned obesity, thyroid disturbance, hepatic and renal degeneration, diabetes.

SENILITY.

Even without definite pathologic change in any organ, the gradual failure of function in old age at once diminishes the need of food and the ability of the digestive, assimilative and eliminative organs to care for more than a moderate quantity. At seventy, not much more than half the standard ration of adult life, is required. Proteids should be kept at the Chittenden minimum, and purin-containing foods should be used in very small amounts. Dietetic excesses, including the use of fodder vegetables in any considerable quantity and, in general, the use of foods theoretically objectionable but usually taken with impunity by active adults, should be interdicted. Alcoholics, in small quantity, are considered allowable by many authorities, to stimulate digestive secretion and to relax the arteries which are less resilient than in youth.

CHAPTER XXIV.

DIABETES.

Glycosuria does not necessarily mean diabetes but if a patient under ordinary conditions of diet and in the absence of other special circumstances, passes urine which gives an unmistakable sugar reaction, the chances are at least nine out of ten that he has diabetes.

In applying the copper test, a muddy precipitate, which does not settle quickly and which does not present a distinct orange tint, often signifies salicyluric acid, due to salicylate medication or the use of preservatives, as in sweet cider.

Concentrated, "febrile" urine, of relatively high specific gravity, and a reddish tinge, especially if depositing urates, will almost invariably cause some reduction of copper solutions.

Almost any urine, if added to the copper solution in greater amount than that of the reagent, will, on boiling, produce a pale, yellowish green precipitate, which the over-anxious physician may interpret as indicating an appreciable amount of sugar.

While alimentary glycosuria may develop in a normal individual after the ingestion of large quantities of sugar (including syrup, candy, fruit, sweet cider etc.), it should not develop unless more than 100 grams of sugar have been taken at once and it often fails to appear after the ingestion of much larger amounts. (The writer, for example, has never excreted appreciable traces of sugar after various experiments with 200—500 grams of sugar.)

Alimentary glycosuria normally occurs when more than the following amounts of carbohydrates have been ingested at once. (von Norden.)

Starch, no limit on account of slow conversion; glucose, 200 grams; laevulose, 140—160 grams; canes ugar, 150—200 grams (saccharosuria may occur without glycosuria); milk sugar, 120

grams (corresponding to about 3 liters of milk); maltose, low limit, so that in many persons glycosuria almost always follows drinking beer; pentoses, low limit, so that nearly half is recovered from urine after administration of 30—50 grams.

The principal causes of non-diabetic glycosuria are:

Exogenic Toxins Causing Glycosuria.

Curare, carbon monoxid, amyl nitrite, methyl-delphinin, morphine, chloral, hydrocyanic acid, sulphuric acid, mercury, alcohol, strychnine, salicylic acid (and salicylates), turpentine, uranium nitrite, benzol, acetone, phloridzin, phosphorus, cubebs and copaiba, diuretin, caffeine (the last two only when the diet is rich in sugar), chloralmid, ether and chloroform and narcotics generally.

Glycosuria due to Disturbed Metabolism in General Diseases.

Various infections, as cholera, intermittent fever, scarlet fever, cerebrospinal meningitis, as well as gout.

Central Nervous Glycosuria.

Experimental puncture of the floor of the fourth ventricle, injury of the vermiform process of the cerebellum, high section of the spinal cord, and various traumatic and succussive injuries of the head, spine, and body generally. Idiopathic nervous diseases, such as major hysteria. Acute hydrocephalus, tuberculous meningitis.

In all suspicious reactions with copper solutions, the presence of sugar should be corroborated by the following test: Mix equal parts of urine and saturated solution of picric acid; add liquor potassae till a red color is produced: boil; a trace of sugar beyond the normal causes a very dark, almost opaque red.

There is no entirely satisfactory nor accurate quantitative test for urinary sugar. For approximate clinical work, either of the following may be used: 1. Add to a large test tubeful of urine, a piece of sugar-free compressed yeast; let stand 24 hours

at a temperature of 70—100; each degree of specific gravity lost indicates one part in 500 or about 1 grain per ounce, of sugar.

2. Get at a reliable laboratory a standard, already mixed Fehling's solution, each 10 c.c. of which corresponds to a definite quantity of sugar, usually 5 centigrams. This will keep for several weeks. Dilute the urine from 5 times for specific gravities of 1020—1025, up to 10 times for specific gravities of 1035 and upward. Place 10 c.c. of the reagent, diluted with 50 c.c. of distilled water, (most oeconomically obtained from reliable water companies), in a conic flask of about 150 c.c. capacity which is set on wire gauze over a Bunsen burner. Drop the diluted urine from a burette into the flask, while the contents of the latter are boiling, until the reagent is decolorized and a deposit of copper oxid is formed. Knowing the amount of sugar to which the given amount of reagent corresponds, the dilution of the urine and its total quantity, the elimination of sugar is easily calculated. It is well to average two or three tests.

Polariscopes are expensive, their satisfactory use requires considerable and almost constant experience and many substances are likely to be present in urine which interfere with the result.

Modified medicine droppers are more troublesome and only slightly cheaper than burettes and the results obtained are very unreliable. Apparatus for measuring sugar by collecting carbon dioxid gas produced by yeast are more troublesome and expensive and no more accurate than the simple specific gravity test described.

A moderately severe case of diabetes on a mixed diet frequently eliminates 300 grams of sugar in a day. 100 grams is a moderate elimination for a mild case on a mixed diet. A "distinct trace" of sugar by the qualitative test means a measurable elimination of 5—10 grams in a liter or a liter and a half of urine. Less than this amount cannot be satisfactorily measured by clinical tests.

A loss in the urine of 50—100 grams of sugar a day, is not serious in itself, nor is the waste of this amount of nutriment a serious matter if the diet can be increased without notably increasing the elimination of sugar. While sugar in the urine may cause

renal or lower urinary inflammation, nephritis coincident with diabetes is probably due to coordinate degenerative lesion.

From the standpoint of the glycosuria, we may divide diabetes into the following groups for dietetic purposes:

1. After a few days of strict diet, the sugar disappears or is reduced to a trace. On resuming diet containing 100—200 grams of carbohydrates, the sugar does not exceed 10 grams. With reasonable care to avoid strain and excitement and with avoidance of malt and sweet liquors, avoidance or slight use of sugar, and moderate restriction of starches, life will probably not be materially shortened and a symptomatic cure may result.

2. The sugar is reduced almost or quite as much as in the first group, but more slowly. On resuming mixed diet, as before, the sugar averages 50 grams, but is reduced as before, if the carbohydrate is allowed in smaller quantities. Carbohydrates should be restricted to cereals including bread stuffs or cream or milk, and the total carbohydrate should not exceed 100 grams. The prognosis is fairly good, but symptomatic cure or indefinite prolongation of life is scarcely to be expected.

3. Considerable sugar persists in the urine on a strict diet and small allowances of sugar or even starch, produce a relatively enormous rise in the urine, even to 500 grams or more. The case is usually hopeless. Acid intoxication, including acetonaemia etc., develops if the diet is kept free from carbohydrates and the various symptoms are aggravated if they are allowed.

Polyuria, polydipsia, polyphagia, high specific gravity of urine etc., usually run fairly parallel with the elimination of sugar.

In noting the progress of a case of diabetes, do not neglect the nitrogenous elimination. Using the hypobromite test (Hind's Doremus' ureometer is the most convenient and accurate for clinical work), the nitrogen elimination, read as urea (though including ammonia etc.), should not exceed 30 grams. It may reach 100 grams or more. This indicates not only a waste of proteid food but of tissue. Usually the nitrogenous and saccharine elimination run approximately parallel.

From the dietetic standpoint, diabetes includes three main factors: 1. Elimination of sugar which, as stated, is not particularly serious unless the amount is great or unless it is formed from the tissues (and proteid foods). 2. Waste of nitrogenous matter, in other words, destruction of tissue. 3. Acid intoxication, including the formation of beta-oxy-butyric acid, diacetic acid and, finally, acetone. (NOTE.—Owing to the lack of unanimity of opinion regrading clinical tests for these substances, they will not be discussed.)

Acid intoxication develops to a greater or less degree in starvation and in all conditions in which carbohydrates are not properly assimilated. It is sub judice whether the condition is due to faulty catabolism of proteids or fats. For practical purposes it is sufficient to remember that it may be prevented by securing the assimilation of about 80 grams of carbohydrate, daily.

Hence it is far less harmful to have a moderate elimination of sugar than to restrict the diet so closely as to produce acid intoxication.

A strict diabetic diet excludes all carbohydrates. It should contain about 70 grams of proteid to allow amply for tissue waste, and enough more proteid and fat to supply from 2,500 calories for a good sized man, exercising considerably but not excessively (all exhausting labor being contraindicated in diabetes), down to 1,800 calories for small adults practically confined to bed.

As the body never digests fats completely, and as the loss in the alimentary canal increases more rapidly than the total ingested, it is rarely advisable to administer more than 200 grams on any one day, nor more than 150 grams a day for any long period.

For mild cases of diabetes the diet should approximate the following standard:

Proteid.....	.150 grams..	..735 calories.
Fat.........	.100 grams..	.930 calories.
Starch......	.200 grams.	.820 calories.
		2485 calories.

There is always some waste of nourishment, amounting to about 10%. The carbodydrate assimilated can be estimated by

subtracting the urinary sugar from the carbohydrate ingested but, if the patient eliminates as much as 10% of 200 grams of carbohydrate, the ingestion should be less.

For moderate cases, the diet should approximate the following standard:

Proteid.	...150 grams..	735 calories.
Fat.	...150 grams..	.1395 calories.
Starch..	...100 grams..	410 calories.
		2540 calories.

If possible, without too much glycosuria or other symptoms, the starch should be held at 80 grams, even allowing for the loss in the urine of 20 grams. The proteid can usually be held at 150 grams and, by the use of digestants, it can be fairly well digested. Fats are less easily cared for, but, by administering them in palatable form, 100 grams daily can almost invariably be given. At least 30 grams can be introduced by inunction, but it is rather doubtful whether fat thus administered, is utilized.

The following may be taken as the type of troublesome cases which approach the immediate danger line, but in which we can still give enough carbohydrate to avert acid intoxication, and in which sugar is not formed out of the tissues. By experiment it has been found that not much more than 80 grams of carbohydrate can be given without considerable loss in the urine, that 80 grams produces a glycosuria of 20 grams, and that the urine will not become sugar-free, except after several days of strict dieting, during which signs of acid intoxication appear. Fats are not well borne in large amounts but 100 grams can be given with about 10% loss in the faeces. Proteid digestion is poor, but 100 grams can be given.

Net proteid..	.90 grams..	441 calories.
Net fat. ...	.90 grams....	837 calories.
Net starch.	...60 grams.....	246 calories.
		1524 calories.

Alcohol can be used to supplement nutrition, to the extent of 25—50 grams a day, by giving it in small doses, without much danger of intoxication, even in the physiologic sense, or of elimination unchanged to any great degree. It yields 7.1 calories per gram.

On the discovery of diabetes, especially if sugar and nitrogenous elimination are high, the case should be placed for a few days on a carbohydrate-free diet. The following conforms nearly to the requirements:

	Proteid	Fat	Lactose
6 eggs........	35 grams	30 grams	
Butter (average normal use)........ . ..		45	
Lean meat, ½ kilo...	100	50	..
Cream, 250 c.c......	7	65	7 grams
	142	190	10 at most of carbohydrate

Calories from proteid, $142 \times 4.9 = 695$
Calories from fat, $190 \times 9.3 = 1767$
Calories from carbohy. $10 \times 4.1 = 41$

2503 total calories.

Meats, including poultry, fish and shell fish may be used freely except that the liver, and other glandular viscera are objectionable as containing glycogen.

Fat is best given in the form of butter, cream (unless absolute exclusion of lactose is necessary), salt pork, bacon, olive oil, mayonnaise, salads with oil etc., gravy etc.

Whipped cream adds to the palatability of various desserts.

Nuts are rich in fat and proteid. The only common nut to be avoided is the chestnut, on account of its content of starch. Peanut butter and various meals and cakes made of nuts may be used.

Broths, meat teas, bouillon and clear soups may be used. Flour, rice, barley, noodles, vermicelli and milk are to be avoided

in making soups. The innutritious vegetables mentioned subsequently may be added.

Saccharin may be used to sweeten beverages, jellies, etc. It is, however, irritating, and in considerable quantities it inhibits digestion. It is permissible in small quantities if not used too continuously. Unfortunately, the appetite for sweets is a genuine one for sugar and not merely the craving of a taste.

Gelatin may be used to prepare meat jellies or, variously flavored, and sweetened with saccharin, to prepare desserts. While not a proteid, gelatin may be used to replace proteid, to the extent of 25 grams a day or thereabouts, provided the minimum of proteid (about 50 or 60 grams) is also given.

Beverages. Tea, coffee, cocoa-nibs but preferably not cocoa, may usually be given with cream or even milk, but not with sugar. Carbonated and mineral waters, Rhine and still Moselle wines, claret etc., but not sweet wines, malt liquors etc., may be used. By using essential oils, citric acid or acid phosphates and saccharin, various fruit beverages may be imitated.

Condiments may be used to give taste and variety to foods.

Gluten, bran, aleuronat, almond flours etc., are available only to a limited degree. Gluten breads rarely contain less than 35% of carbohydrates and while, in theory the reduction of carbohydrate from 50% or 60% is considerable, patients will usually prefer the use of real bread stuffs in correspondingly less amount.

A nearly carbohydrate-free milk may be prepared as follows: To 1 liter of skimmed milk, add 100 c.c. of 10% glacial acetic acid. After 15 minutes, filter through fine muslin without pressure. Rub up the curds to a fine paste and wash twice through the filter, using ½ liter of distilled water each time. This leaves the casein, free from lactose. Dissolve the curds in liquor potassae, using about 100 c.c. of a 2.5% solution, testing separate portions with phenolphthalein, so as to stop just short of complete neutralization. Add 100 grams of clotted cream, to bring the fats to the normal. Add 5 grams of gelatin, previously dissolved to give the proper viscosity. A little saccharin may be added to give the normal sweetness of milk. Make up the dissolved curds to the original volume, 1 liter. This has almost the normal nutri-

tive value of milk, less the lactose, and can scarcely be distinguished by the taste.

Innutritious vegetables which may be used to give bulk and variety to the diet and to facilitate the use of meat, salad dressing etc., but which contain scarcely any digestible carbohydrate are as follows: cabbage, cauliflower, artichokes, Brussels sprouts, broccoli, green string beans, mushrooms, tomatoes, lettuce, endive, coleslaw, olives (which contain some oil), cucumbers fresh or pickled, including gherkins, young onions, cress, mustard, and the green ends or tops of asparagus, spinach, dandelion, turnips, celery etc.

Eggs may be used in a great variety of ways, including custards sweetened with saccharin, and cakes, provided there is no objection to the use of small quantities of carbohydrate in milk, flour, etc.

Fruits except those obviously starchy, as bananas, or quite sweet, may usually be given in moderation. Often diabetics can take considerable quantities of fruit sugar (laevulose) which is found in many fruits.

Vegetables to be particularly avoided on account of their richness in starch are: potatoes, Irish and sweet, beets, carrots, turnips, parsnips, peas and beans, all cereals and, hence, bread stuffs.

Remember that all lists of what the diabetic may and may not take, are arbitrary. Very few natural food stuffs, especially vegetable, are entirely free from carbohydrates. Malt liquors and sweet beverages, especially cider and wines, seem to have a worse effect than can be explained by their content of sugar. Otherwise, and allowing for idiosyncrasies, it makes very little difference what food the diabetic takes, providing the total ingestion of carbohydrate is within the limits of his power to oxidize sugar in the blood.

Most diabetics can and should take moderate quantities of foods containing carbohydrates. Oefele states that 88% can take 35 grams of cane sugar a day (6 ordinary lumps). It is safer not to give cane sugar, malt sugar or dextrose but as much as a liter of milk, containing about 40 grams of lactose may usually be taken in a day. 100 grams of Irish potato (one ordinary sized

potato) contain 2 grams of proteid and 20 of starch. 100 grams of bread stuff (about 2 ordinary slices of bread, 20 small round crackers) contain about 50—60 grams of carbohydrate. Oatmeal and other cereals contain about the same percentage and an ordinary serving for breakfast, 30 grams, may usually be given.

Remember that there is no special virtue in the milk cure, oatmeal cure, potato cure etc., as applied to diabetes. Any or all of these and other foods may be used, provided the carbohydrate does not exceed the amount which can be assimilated without too great glycosuria.

Remember that it is better for the diabetic to have too much sugar in the urine than too much acetone, and its congeners in the blood. The diabetic who seems to require a continued, carbohydrate-free diet will die anyway.

Learn to know the composition of the ordinary foods, at least approximately, and to have some idea of the actual weight, and, hence content in fat, proteid and carbohydrate, of ordinary servings.

Be sure that the diabetic has his food well cooked and neatly served. Give him as great a variety as possible, especially by using different flavorings and methods of serving the standard diet. There is no other disease in which it is so important to cater to the appetite of the patient while insisting on the principles of dietetics. If this precaution is not followed, the psychic hardship will react upon the diseased process or else the patient will break loose from restraint and will kill himself by dietetic excesses.

Remember that neither the dietetic nor other treatment of diabetes can be intelligently carried out, unless we have an approximate knowledge of what the patient ingests and what he excretes. This does not mean that all of his food and excreta must be measured and analysed daily, as in performing metabolism experiments, but it does mean that the approximate clinical estimations must be made frequently.

It is senseless to let a patient take carbohydrates and then administer yeast to decompose them. It would be more rational to let him eat and then make him vomit.

Remember that the diabetic may present special contraindications to any of the foods allowed in diabetes, just as if he were free from the underlying disease. If this contraindication is important, as in complicating nephritis, hepatic sclerosis or essential digestive failure, a compromise must be effected according to the merits of the individual case.

CHAPTER XXV.

OBESITY AND LEANNESS.

Under the consideration of glycosuria and diabetes, we have seen that the unoxidized sugar accumulates in the blood—and, indeed, in other juices of the body—whence it is removed by the urine and, to a less degree by other secretions. In the extreme form of diabetes, not only is there failure of oxidation of sugar derived directly from ingestion of carbohydrates, but sugar is produced in the body from fats and proteid.

Except that unoxidized fat does not accumulate especially in the blood and is not removed by the secretions—owing to its physical state and insolubility in water—but accumulates as inert, practically foreign matter in the cellular tissues, and excepting that the mechanic symptoms of fat accumulation are greater than those of sugar accumulation and that the loss of energy by failure of oxidation of fats is relatively insignificant, as compared with that of sugar, obesity is analogous to glycosuria and diabetes in each of these three stages.

Corresponding to glycosuria, is obesity of mild degree, due to disproportion between supply of food and oxidation. There are, however, these practical differences: Glycosuria not amounting to true diabetes never occurs except after the ingestion of excessive amounts of sugar of one kind or another, as discussed elsewhere while obesity may occur not only from abnormal ingestion of fats but even more so from abnormal ingestion of carbohydrates and even of proteids, since all organic foods may be changed into fat and since an excessive increase in the ingestion of fat results in catharsis and failure of primary digestion and absorption.

Corresponding to true diabetes of mild degree, whose hyperglycaemia and glycosuria may be controlled, by limiting the diet,

is a more marked degree of obesity, but which may be reduced or at least kept stationary by dietetic limitation and measures directed toward an increase of oxidizing power.

Corresponding to diabetes in which sugar continues to appear after the elimination of carbohydrates from the diet, on account of the transformation of fats and proteid into sugar, is a grade of obesity in which, after the total elimination of fats from the diet and even the reduction or carbohydrates and proteid far below the needs of the body, fatty deposit continues. Such an extreme grade of obesity seems to be a generalization of the well recognized local process of fatty degeneration.

In all grades of obesity, by clearing out the bowels and reducing the ingestion of all substances, especially water, a rapid initial decrease of weight may be secured. While such procedures may be indicated on other grounds, they are obviously fallacious so far as the reduction of obesity is concerned, since they merely remove substances not properly part of the body. The rate of decrease cannot be maintained except by inducing phases of starvation, and, in the extreme grade of obesity, the patient may even starve to death without a notable loss of fat.

In obesity of the lowest grade, the management of the case—barring other indications—is purely hygienic and dietetic, and is both simple and satisfactory except that established customs of relative overeating can not be changed without considerable mental hardship and even hunger and genuine weakness due to the failure of the body to accommodate itself to the necessity of greater assimilative oeconomy. As in the limitation of other appetites, ultimate success depends upon the courage and perseverance of the patient.

Different individuals differ greatly in the oeconomy with which they digest, absorb and assimilate the respective kinds of organic food (proteid, carbohydrate and fat). Moreover, caloric needs differ according to exercise, exposure to cold, mental effort, sexual expenditure of energy, circulatory and respiratory facilities for oxidation, activity of oxidative ferments, loss of calories by radiation and perspiratory evaporation, etc. A short, compact, rounded figure affords less area for the last two sources of

loss of calories and even for the oeconomic distribution and utilization of nutriment, than one of the same mass, but long and angular. In all these ways, obesity tends to establish a vicious cycle by preventing the consumption of heat units.

Bearing in mind these various factors, the treatment of obesity consists of a hygienic regimen to increase oxidation and elimination of heat units and a dietetic regimen to produce a deficit of heat units demanding compensation by the oxidation of deposited fat.

At the outset, it is obvious that an unreasonable restriction of water tends to lessen the elimination of heat units by evaporation and interferes in various ways with the physiologic processes necessary not only for the preservation of general health but even the accomplishment of the immediate end of reduction of fat. So, too, the reduction of proteid below the minimum of about 60 grams a day, also acts in the last two ways.

Exercise sufficiently active to produce perspiration is of great value if not contraindicated by a weak heart or brittle arteries. Every liter of sweat indicates the consumption of 580 calories, or of 62 grams of pure fat or the reduction of weight by 75 grams. At this daily rate, the reduction of weight would amount to about 2¼ kilograms or about 5¼ pounds a month.

Even the excessive reduction of purely calorific foods, fat and carbohydrate is contraindicated, partly because of the general reduction of bodily strength, partly because of special factors concerned in the oxidation of fat.

Every kilogram of adipose tissue contains about 800 grams of fat, whose complete oxidation would yield about 7500 calories, or sufficient to maintain the heat and energy of the body for three days, on the average. Thus the theoretic maximum of fat reduction, is only a trifle over 2 kilograms or about 5 pounds a week. But the healthy body can not oxidize sufficient fat to furnish all its daily requirement of energy, much less the obese body. Even if it could do so, there would be an inevitable partial failure of oxidation, resulting in the formation of fatty acids and producing a serious toxaemia.

The safe limit of fat oxidation a day, is somewhat less than

150 grams or about 1000 calories. Thus, we may reasonably endeavor to secure a corresponding oxidation of deposited fat to this extent, corresponding to a weekly loss of weight of about 1 kilogram (2.2 pounds). Deducting the 1000 calories from the ordinary daily requirement, the diet should therefore, yield about 1500 calories.

In establishing such a diet, it is advisable to omit butter and fat meat, to use milk instead of cream, and to omit sugar and most starchy foods. It is not necessary—and it would be impossible—absolutely to avoid the administration of fat and sugar. A ration fairly corresponding to the requirements, is as follows:

Viand	Weight Grams	Calories due to Proteid	Fat	Carbohydrate
1 shredded wheat biscuit..	27	13.	4.5	82.5
Lean meat.......... ...	200	160.	240.	..
Milk....	280c.c.	38.	104.	58.
Bread (toasted if wished).	100	36.	16.	240.
Crackers (about 2 soda)	50	20.	45.	150.
Eggs, 2.......	...	64.	136.	...
Potato (1 large or 2 small).	100	11.	1.	88.
Fruit, 1 apple....... ...	..	1.5	3.5	45.
1 orange....... ..		3.	1.5	45.
		346.5	541.5	708.5

The total caloric value of the above ration is 1596.5 and the proteid in grams (obtained by dividing the proteid calories by 4.5) is 77.77. Various cereals, kinds of meat, fruit etc., may be used, as well as moderate amounts of weak tea and coffee, with milk instead of cream. By cutting down the meat, eggs or milk, the proteids may be reduced to the Chittenden standard and, even without this reduction in calories, considerable allowance of relishes, such as radishes (not olives), lettuce, cabbage and various other innutritious vegetables may be made. Not only are such vegetables poor in nutritives but such as they do contain are imbedded in cellulose so as to be wasted to a large degree and, by

stimulating peristalsis they increase the waste of other nutriments. In general, bulky foods are to be preferred, as they satisfy the appetite with minimum quantities of nutriment. For instance a popper full of pop-corn weighs only about 20 grams, and contains only 80 calories.

The writer would condemn the use of yeast to destroy carbohydrates ingested—purposive vomiting after satisfying the appetite is just as rational and less harmful—, of vinegar, soda etc., to interfere with digestion, of cathartics to diminish the time and thoroughness of intestinal digestion, of any exclusive diet as of meat, grapes, oatmeal etc., or in short of any extreme measure interfering with assimilation.

The use of tobacco, which diminishes oxidation, should be interdicted or much restricted. Exercise, to the point of producing perspiration but not excessive fatigue, avoidance of too heavy clothing, day or night, deep breathing, stimulation of the skin and circulation by baths, alcohol rubs etc., are hygienic measures favoring oxidation.

In obesity of the second grade, there is a genuine diminution of the oxidizing power and, unfortunately, we do not know exactly where this function resides nor how it works. In addition to the methods described, it is advisable to stimulate fat oxidation directly. Thyroid extract and ovarian or testicular extract according to sex, have been suggested on theoretic grounds and sometimes work well. The administration of oxygen in adequate amount is impracticable and probably would be unavailing, as the real failure is of some oxidizing agent, probably a ferment.

It should not be forgotten that the reduction of fat is less important than the maintenance of general health, so that extreme dietetic measures should not be undertaken.

Obesity of the third degree is distinguished by the failure of all measures and the further deposit of fat. The theoretic indications are the same and it is even more important than in the lower grades, not to weaken the patient by ineffectual starvation, since the impoverishment of nutrition actually increases the tendency to fatty degeneration.

Leanness.

While at first thought, leanness appears to be the opposite of obesity only, it really consists in a relative or absolute superoxidation at least of carbohydrates, as well as fats, and perhaps of proteids also, since the deposited fat is, to a large extent, derived from these sources. We may carry the analogy so far as to say that leanness exists in two degrees, corresponding to glycosuria and to alimentary obesity. The first degree is due to the fact that the exercise, fatigue, mental strain and the perspiration, exposure to cold and other causes of heat abstraction exceed the average intake of calories, so that while the individual may be very far from starvation, and may actually eat more than the average ration, his diet is too meagre to allow the deposition of more than minimum quantities of fat.

The second degree of leanness implies that on a diet considerably in excess of the theoretic demands of the body and with no detectable excess of digestive waste, the individual cannot deposit the normal amount of fat.

There is, strictly speaking, no third degree of leanness. While the patient may become emaciated from lack of food, from stricture of the oesophagus, from achylia totalis (as in Addison's disease) from malignant disease, diabetes etc., there is no essential metabolic condition in which the superoxidation of nutritive material not directly connected with deprivation or with suboxidation in other respects, threatens life or the maintenance of the ordinary functions of the body.

Leanness not directly connected with absolute or relative deficiency of food nor with some obvious pathologic explanation, is usually found in persons of tall and angular build, so that the opportunities for heat loss by evaporation and radiation are relatively great and the condition is, to some extent, a family tendency.

Some cases, especially in women, are relieved by increasing the amount of clothing habitually worn. Otherwise, the treatment consists in carefully increasing the diet, especially in carbohydrates and to some extent fats. Often it is advantageous to

administer one or two light luncheons in addition to the regular meals. An abundance of sleep should be taken and mental worry should be reduced to a minimum. It is a mistake to attempt an excessive diet or to reduce the physical exercise unduly. Care should be taken to detect digestive errors, alimentary saprophytosis etc. In intrinsic cases, the prognosis with regard to increasing weight is not very good, but the health is or may usually be rendered excellent and with advancing years there is usually a tendency to take on flesh.

CHAPTER XXVI.

CHRONIC DISEASES OF NITROGENOUS METABOLISM.

Under the one term, rheumatism, are included a number of conditions which may be of entirely distinct pathogeny. Acute articular rheumatism will be considered among the infections, although it is not certain whether it is a specific disease or due to mitigated bacteria of various types. Some have considered it as a mitigated sepsis. It is also uncertain whether there is any real connexion between what is ordinarily called chronic rheumatism and acute articular rheumatism, either in the sense that the chronic form is a persistence of the latter or of its results or that acute articular infectious rheumatism requires for its lodgement, the metabolic state characteristic of so-called chronic rheumatism.

It is also in dispute whether arthritis deformans is a distinct disease, or whether the name is applied to two or three sub-types or superficially similar but really distinct diseases and, if so, whether any or all of these are essentially different from chronic rheumatism.

In typic gout, the presence of an excess of uric acid in the system, the deposit of uratic concrements in the joints, and the general relation of the exacerbations and remissions of the disease to period of retention and marked elimination, have been rather positively demonstrated.

Lithaemia, though the term is often misapplied, seems also to consist in an excessive introduction or endogenic formation of uric acid and its congeners, the purins generally. The general conception that it is a mild or atypic form of gout also seems to be correct. How far chronic rheumatism and lithaemia are identical, is disputed.

A very practical question is as to the truth of the older theory that uric acid etc., are nitrogenous waste that has failed of

relatively complete oxidation into urea and of the more modern theory that the former are absolutely independent of true proteid metabolism and due either to introduced free purins or nuclein compounds or to endogenic metabolism of similar compounds which are originally formed from purin foods or from proteid.

The consideration of this entire problem is further confused by the occasional exacerbation of gout and chronic rheumatism by certain starchy and saccharine diets and by the claim made by some that lactic acid is the cause of the trouble.

It does not appear either on any single theory as to the nature of these diseases nor clinically, that there is, with regard to proteid, a close analogue to either diabetes or obesity, in the sense that a distinct disease results from the impaired ability of the body to oxidize proteid foods.

All things considered, it must be admitted that the dietetic management of the diseases here, as commonly, grouped together, rests on an empiric basis, none too firm, and not in all respects conforming to the most accepted theories.

However, typic gout and, to a less degree, chronic rheumatism and lithaemia are produced by overindulgence in eating and drinking, especially in regard to meaty foods and alcoholic liquors. It can scarcely be said that the classic victim of gout is of sedentary habits, until these are forced upon him by the disease or advancing years or both; chronic rheumatism occurs by preference in those who have led rather active, out-of-door lives, with exposure to cold and damp; lithaemia alone corresponds to the a priori conception of a sedentary, in-door life, with resultant insufficiency of oxidation.

It seems to be advisable, in all diseases of this nature, to reduce the proteid ration nearly to the Chittenden minimum although, in the so-called "poor man's gout", we may find a ration inadequate in all respects and the same is true for many cases of arthritis deformans, and even for some of chronic rheumatism and lithaemia.

On the other hand, it is inexpedient to establish a diet excessively rich, absolutely or relatively, in starches, sugars and

fats, since they probably tend ultimately to produce an excess of oxalates in the system.

The prejudice against red meats seems to be entirely without foundation.

Alkalies, including juicy fruits such as orange and lemon are usually considered to be indicated, especially in gout, chronic rheumatism and lithaemia but the urinary acidity should be tested, for it is by no means always high.

Water should usually be given rather freely, yet, as many cases in this group tend to develop interstitial or diffuse nephritis, there is no wisdom in advocating excessive quantities.

Glycosuria—which must not be confused with the slight reduction of copper solutions by uric acid and urates, salicyluric acid from medication, etc.,—diabetes and obesity show some tendency to complicate gouty and lithaemic cases, and the diet should be regulated accordingly.

The toxicity of uric acid is not conspicuous although its presence in excess seems to indicate perverted metabolism and, very likely, the presence of some more toxic congener or congeners. The urinary elimination is not a reliable index to the amount in the system, either directly or by suggesting a reciprocal relation. A single estimation is of practically no value. However, if daily examinations show repeatedly a low elimination, followed by a sudden rise and then a fall, as is the case in gout in passing a crisis, we may safely diagnose retention followed by a discharge.

Although the relation of this group of diseases to uric acid is not entirely clear, it seems advisable to avoid the purin-containing foods as much as possible (See Tables, Chapter XIV), and also to avoid vegetables and fruits rich in oxalates, all foods that tend to produce fermentation and putrefaction, and to make the diet a simple one based largely on milk, eggs and cereals, including bread stuffs.

CHAPTER XXVII.

DISEASES OF THE URINARY ORGANS.

Albuminuria, though not a definite disease, deserves special consideration from the dietetic standpoint. Unlike glycosuria, to which it bears but a superficial analogy, and unlike various other manifestations in the urine, it is, for the most part, due strictly to local conditions, although, in many instances, as for example in renal congestion, the local condition is due in turn to general conditions.

Albuminuria, analogous to glycosuria, occurs only after the entrance into the blood of foreign albumin. It is nearly limited in practice to the passage of egg albumin, after the ingestion of raw eggs, five or six eggs being necessary to produce this phenomenon. It is not a sign of disease but it may be important to estimate approximately the amount of nutriment wasted. Apparently no harm follows this elimination of albumin.

Adventitious albuminuria due to the entrance of lochia, vaginal discharge, semen etc., must be excluded. So, too, must be excluded reactions with nitric acid due to balsamic preparations, etc.

There must also be differentiated essential albuminuria due to leakage through the kidneys, from albumin in the urine emanating from inflammatory, suppurative and haemorrhagic discharges along the urinary passages. While the loss by such processes may be considerable, no dietetic problems are presented except as for similar processes elsewhere and to avoid irritation by oxalates, purins, volatile poison, setc.

The bulk of precipitated, moist albumin, greatly exaggerates the impression of loss of proteid. Coagulating by heat and centrifugalizing thoroughly, the volume percentage of albumin is 6—10 times that of dry albumin by weight. Purdy's method, in which precipitation is secured by adding to each 10 c.c. of urine,

3 c.c. of 10% potassium ferrocyanid and 2 c.c. of 50% acetic acid, exaggerates the true proportion of albumin about 50 times.

Barring gross haemorrhage, the urinary albumin varies from a normal trace to 4% (in terms of dry albumin). 1% is rarely exceeded, in inflammatory conditions with copious discharge of leucocytes. In chronic interstitial nephritis, $\frac{1}{3}$% is rarely exceeded —5 grams for 1500 c.c. of urine. More than 2%, not due to haemorrhage, indicates extreme degeneration of the renal epithelium. In such instances, the urine is usually scanty, not exceeding 500 c.c. in 24 hours, so that the loss of albumin rarely exceeds 10 grams. It is probably a conservative statement that, barring haemorrhage or copious discharge of pus and confining our attention to filtration from the blood, the maximum loss of albumin in the urine is 20 grams a day.

Hence, it can almost never happen that the mere loss of nutriment by albuminuria assumes serious importance. Neither does the actual or relative quantity of albumin correspond closely with the functional or organic condition of the kidneys. Still, barring fluctuations, the relative amount of albumin does indicate to some degree the severity of the lesion and if the percentage is greater than 2 and the urine considerable in amount, the actual loss is worth considering, especially as the centrifugal method is easy and fairly accurate.

In **acute nephritis,** the diet should be bland, easily digested, free from purins, and should approximate the physiologic minimum in all respects. While about 60 grams of proteid are required, it is well to avoid meats, using eggs—which should be cooked to avoid the passage of undigested, foreign albumin through the system—milk, and cereals. Salt should be given to the amount of about 10 grams daily. The total quantity of water should be adjusted to the amount eliminated by the skin and bowels. Even if diaphoresis is not secured, about 2500 c.c. are required daily, though not entirely as a beverage.

It should be remembered that, although there is a general indication for adequate nutrition and for elimination, the indication to spare the kidneys outweighs both the indication to nourish and to wash out waste material by excessive diuresis. On the

other hand, the general opinion is that less strain is imposed on the kidneys by the passage of fairly dilute than of concentrated urine. Dropsy is not usually excessive and it does less harm than the immediate attempt to force the kidneys to eliminate resorbed transudate. Excessive urinary acidity—more than 50% by phenolphthalein and decinormal alkali—should be relieved by the use of fruit beverages, such as orange and lemonade or, if necessary, by the use of alkalies.

Anuria is best relieved by high enemas of physiologic salt solution at a temperature of 120° F. If there is no considerable dropsy, water and fruit juices should be given freely. Milk is the best form of food.

Chronic Nephritis. The dietetic causes of chronic nephritis, mainly of the interstitial type, and operative only when acting for a considerable time, are as follows:

1. The ingestion of excessive amounts of proteid, on account of the catabolic irritants produced. While it is the present fashion to emphasize the next cause and while the older theory of the production of uric acid etc., by suboxidation of proteid is denied, the general belief that excessive proteid consumption may produce nephritis, is probably correct.

2. A fortiori, the ingestion of large amounts of purin-containing foods, especially animal viscera.

3. The ingestion of excessive amounts of salines, on account of osmotic disturbances or direct chemic irritation of the kidneys. The continued use of hard or alkaline or mineral waters comes under the same category.

4. Any dietetic excess in the way of carbohydrates, especially sugars, which increases diuresis continually; or a relative excess in conditions of impaired carbohydrate metabolism, allowing glycosuria.

5. The excessive or insufficient use of water.

6. The use of water in any way impregnated with lead, arsenic etc.

7. The use of foods containing preservatives, such as sulphites, formaldehyd, borax, boric acid, salicylates etc.

8. The use of food auxiliaries which disturb arterial pressure, or irritate the kidneys directly, as tea, coffee, alcohol, spices, etc.

9. The use of vegetables containing notable amounts of benzoates, oxalates etc.

10. Dietetic causes of all kinds producing gastro-intestinal fermentation or putrefaction or both, especially the latter, and yielding indican and other substances irritating to the kidneys.

The ordinary case of chronic interstitial nephritis progresses very slowly, is nearly free from dropsy and the general health is only moderately impaired. Thus moderate mental and physical exertion is not contraindicated and the patient requires rather full nutrition.

It is of practical importance to bear in mind that cases of this nature, i. e., those in which there is a chronic lesion but no great disablement, should be restricted in diet as inconspicuously as possible, not only to save the patient discomfort and embarrassment but to avoid the business loss which results from a realization on the part of his associates that he has a physical handicap. A large part of the serious professional, political and financial work of the world is carried on by men with chronic interstitial nephritis and their influence would be diminished or their positions lost if this were generally recognized.

The diet should be largely but not exclusively vegetarian. In any one day, we may allow 1000 c.c. of milk, corresponding to about 40 grams of proteid and 700 calories, or 6 eggs corresponding to 45 grams of proteid and 500 calories, or 200 grams of beef, lamb, fish etc., corresponding to about 40 grams of proteid, the calories varying widely according to the amount of fat. Bacon and salt pork containing little lean, may be used up to the tolerance for fat. Obviously the above quantities of milk, eggs *and* meat, should not be given on the same day, nor is it advisable to give the full amount of any one continuously. On the contrary, it is best to vary the diet from day to day.

The patient should avoid animal viscera, meat soups, broths,

teas; vegetables rich in oxalates; condiments; excessive amounts of salt; tea, coffee, chocolate and alcoholics, unless in minimum amount; and considerable quantities of vegetables rich in cellulose and poor in nourishment. Fried foods should be avoided and, in general, all foods found to digest with difficulty or to disagree with the patient. Special pains should be taken to secure fresh, untainted foods of all kinds, particular caution being needed with regard to poultry, fish and shell fish The meals should be taken.regularly and the luncheon and dinner should be approximately equal.

Concomitant cardio-vascular lesions should receive appropriate treatment.

Toward the close, such cases usually require confinement to the house or bed, the diet must be much simplified, tending toward that advised for acute nephritis, meats must usually then be almost entirely eliminated and the tendency to anaemia may be met by the use of iron, which is also indicated in inorganic form or as a vegetable acid salt, for its supposititious astringent action on the kidneys.

Chronic Parenchymatous Nephritis cannot be separated from the interstitial form with any certainty, as regards the dietetic causes nor is any given case of chronic nephritis purely of either type. Genuinely chronic cases of nephritis, that is to say those which do not exist as a protraction of an acute parenchymatous case and which last for years, are mainly of the interstitial type.

Cases in which the parenchymatous element is important, usually tend either toward dropsy or toward uraemia, the distinction sometimes being surprisingly clear cut. In these cases, there are also usually more complications due to the heart and to gastric function, which embarrass the dietetician, than in more strictly interstitial cases.

In dropsy, the water and salt should be restricted, but excessive thirst and concentration of urine should be avoided.

The appearance of uraemic symptoms usually requires the temporary suspension of feeding and the use of hot physiologic salt solution by bowel. When it becomes necessary to nourish or when the uraemic manifestations are slight, it is best to use an exclusive milk or milk-cereal diet, returning to a fuller diet, as for interstitial nephritis, when the symptoms abate.

Predigestion and the use of small, rather frequent meals, is often required in this type of cases, on account of the cardiac condition and the reaction upon the digestive function.

Amyloid Disease, if recognized, requires the diet appropriate to the underlying tuberculosis, syphilis or septic state, modified in each instance, according to the functional capacity of the kidney.

Calculus Disease calls for a liberal use of water, excepting temporarily in conditions of obstruction of the passage. If the obstruction is more than transient, operation is urgently indicated.

Occurring in acid urine are calculi of uric acid, urates or both and of oxalate of lime. The former are due to the excessive ingestion or formation within the body of purins and it is yet too soon to discard the old belief that excess of proteid also has this tendency. Aside from avoiding the dietetic causes, the prophylaxis and treatment (so far as the latter is of avail) consist in the use of water and fruits or alkalies to render the urine slightly alkaline or at most weakly acid.

Calcium oxalate is mainly formed in the urine by fermentation after voiding. However, oxalic acid is normally eliminated up to 2 centigrams a day and it is increased in diabetes, organic diseases of the liver and conditions of suboxidation generally. Apparently, it is formed in the intestine and in excess in various forms of dyspepsia, particularly intestinal dyspepsia following hypochlorhydria. It may be formed chemically from almost any organic food and there is a dispute whether it is more likely to be produced in the intestine in excess on a starchy and saccharrine diet or on one rich in proteids.

Klemperer holds that calcium oxalate cannot be precipitated from the urine unless the magnesium oxid falls below 2 parts in 10,000 and the lime exceeds this proportion. The former requisite is maintained by administering small doses of magnesium salts, the latter by avoiding excess of spinach, fresh vegetables generally, milk and eggs but, obviously there are usually contrary indications which require the fairly liberal use of one or more of this group.

Vegetables especially rich in oxalic acid and hence to be avoided are: sorrel, rhubarb, tomatoes, asparagus, spinach, onions, cabbage, some grapes and apples.

In alkaline urine, there are two types of calculus, the phosphatic consisting of calcium phosphate, with ammonio-magnesium phosphate if there is ammoniacal decomposition, and the carbonatic, consisting of calcium carbonate with small amounts of magnesium carbonate. Both are prevented by keeping the urine acid and the latter rarely develops except in herbivorae—in man only when the diet is excessively rich in fruits containing vegetable acids which decompose with formation of carbonates.

Even in ammoniacal decomposition, the urine is usually quite promptly rendered acid by the administration of ammonium benzoate. Cranberries, which naturally violate the Pure Food Law by their high content of benzoic acid, may be employed. By minimizing the use of fruits and juicy vegetables and increasing the amount of proteid, especially meat, a sufficient urinary acidity can be maintained.

Very rare urinary calculi are composed of cystin, indigo, urostealith and xanthin. The first two are due to excessive intestinal putrefaction whose dietetic prophylaxis and treatment are considered elsewhere. Causs claims that contaminated water may contain notable amounts of cystin, 3 milligrams per liter in the Rhone, 3 centigrams per liter in a well contaminated with typhoid discharges.

Urostealiths are soaps of magnesium and calcium and, as the metals are always present in the urine, the essential cause is fatty degeneration in the urinary passages or possibly the elimination of fatty acids in fat necrosis and fatty acid intoxication. Except in a very recondite degree, the former is not amenable to dietetic prophylaxis or treatment and the dietetic relations of the latter two are considered elsewhere.

Gonorrhoea. It is probably a conservative statement that many cases could be cured by diet alone, if placed immediately upon a bland, semi-liquid diet, free from purins, oxalate-containing vegetables etc., and with sufficient fruit and alkali to render the urine continuously alkaline.

Priapism and ardor urinae are largely preventable, at least, by such a diet.

In all acute cases; alcohol, tea, coffee, chocolate, animal viscera, spices, more than a minimum amount of meat and salt, as well as all rich, greasy or otherwise indigestible foods, should be excluded. Water and fruit juices, as in orange and lemonade, lime juice etc., should be freely administered and sodium bicarbonate may be given to the extent of a teaspoonful a day.

In order that reflex genito-urinary reflexes due to overfulness of the bladder may not appear at night, the evening meal should be light and should occur at least three hours before bedtime, and very little liquid should be taken in the evening.

Similar genito-urinary reflexes, often taking the form of **Nocturnal Emissions,** occur independently of gonorrhoea and are often due to excessive amounts of urine or to urine that is too acid or too highly concentrated. Highly acid urine is not, however, by actual test, found to be so common a cause of such reflexes as is ordinarily supposed. In all such cases, the heartiest meal should be taken about noon and while plenty of water, fruit etc., should be used during the day, as little as possible of these diuretic substances, should be taken in the evening. Too highly seasoned or indigestible foods, alimentary saprophytosis, especially of the form of putrefaction, are also common causes of such reflexes.

Prostatic Hypertrophy and Chronic Cystitis, singly or combined, are especially frequent in elderly or old men and the symptoms are much aggravated and the general health undermined by loss of sleep due to the inability of the bladder to retain a sufficient amount of urine. In other cases, with or without these local lesions, there is a chronic nephritis, in which there is a tendency to an excess of nocturnal over the day urine. In these cases, the dietetic regimen just described is appropriate. Care should be taken, however, that in the endeavor to avoid urinary discomfort, the system is not deprived of water.

CHAPTER XXVIII.

DISEASES OF THE DUCTLESS GLANDS—ORGANOTHERAPY.

The Spleen is not definitely connected with any clinical symptom complex analogous to exophthalmic goitre, myxoedema etc., nor is there any demonstrated efficacy of splenic extract or a corresponding antibody. While rather high in its content of nucleins, not to mention the contained blood, spleen is said to be nutritious. In splenic lesions, dietetic management must conform to general principles and special indications which are determined mainly by other pathologic features of the case.

The Suprarenal Bodies, aside from their nervous structure, consist of glandular tissue which secretes into the blood, adrenalin, whose function is the maintenance of vascular tension, and which apparently contracts smooth muscular tissue generally. Adrenalin, suprarenal extract or the bodies themselves, are therefore indicated in shock, capillary haemorrhage—although the general rise of blood pressure may increase the haemorrhage in certain cases—in certain cases of asthma etc., also in general cardiovascular weakness. The local application to the pancreas and excessive general administration has caused glycosuria in animals, also arterio-sclerosis but the doses and method of administration or application are hardly comparable to the reasonable theraupetic use and the lesions have been produced mainly in rabbits, which are prone to vascular degeneration, experimentally. Hence the contraindication to the theraupeutic use is doubtful.

The only clinical symptom-complex related to the suprarenal gland is Addison's disease, in which adrenalin is apparently deficient. There is no recognized opposite disease of suprarenal function. E. W. Adams (Practitioner, Oct., 1903,) collected 97 cases of Addison's disease that had been subjected to organotherapy, with the following results: 43 negative; 31 improved; 16 cured;

7 exacerbated. The last group may indicate that Addison's disease sometimes corresponds to excessive function. Richon (Arch. de Med. des Enfants, June, 1903,) reports a cure of Addison's disease, the patient dying after a year of general tuberculosis and the suprarenals being found normal. Thus, on the one hand, there is good ground for using suprarenal extract in Addison's disease and on the other hand, it should be used with caution.

Many, perhaps the majority of cases of Addison's disease, are due to a tubercular focus, hence the diet should be as for tuberculosis in general, unless there is special indication to the contrary.

Advanced Addison's disease is usually attended by a failure of ferments, including achylia gastrica, pancreatica etc. Thus the diet and use of digestive ferments should be directed toward this failure though the prognosis is very unfavorable.

The Thymus is obviously connected with foetal and early extra-uterine development. Friedleben has found the thymus small in 300 necropsies on rhachitic infants and claims good results in non-tuberculous cases from the use of thymus extract in daily dose of 1 c.c. for each month of the child's age. Stokes, Ruhräh and Rohrer (Am. Jour. Med. Sci., Nov., 1902,) also claim that infantile marasmus is always accompanied with thymic atrophy.

So-called thymic asthma and sudden death in children with enlarged thymus has been considered due to hyperthymism but no antibody is known and the cases do not usually come under medical care till too late for dietetic treatment.

Thymic extract has been used as a substitute for thyroid extract but with doubtful results.

Thymus as an article of food is known as sweetbread and is considered superior to the abdominal sweetbread or pancreas. It is rich in purins (see discussion of purin foods) and is indicated or contraindicated accordingly. There is no objection to its use as an occasional delicacy by healthy persons.

The Thyroid when atrophied or depressed in function, is connected with myxoedema as a clinical manifestation and when hypertrophied or exalted in function, with exophthalmic goitre. Congenital absence or degeneration causes cretinism. There is

no uniform correspondence between the size of the gland and its functional state nor is any single lesion associated with either depressed or excessive function. Obesity is sometimes a manifestation of thyroid failure, as are certain vague conditions especially seen in elderly women. Hyperthyroidism is also frequent in atypic manifestations, especially in young girls with menstrual troubles. Glycosuria is apt to mark hyperthyroidism and true diabetes may be associated with either type of thyroid disturbance.

Great benefit has been obtained in many cases of cretinism, practically a cure in many of myoedema, relief or cure in some of obesity and general disturbances of nutrition in old age, from the use of thyroid extract, iodothyrin, or fresh glands and apparently the use of these remedies is as efficient by ingestion as by injection. Obviously, the use must be continued, with care to avoid hyperthyroidism, unless in mild cases when the gland may apparently regain its functional activity.

In exophthalmic goitre and hyperthyroidism generally, the milk fresh or dried, or serum of thyroidectomized goats or sera produced by injecting animals with thyroid extract or even with extracts of diseased human thyroids, have been used, sometimes with benefit, sometimes without. Adrenalin has a decided action in controling hyperthyroidism.

Cretinism is decidedly endemic in mountainous districts, notably the Alps and Himalayas. A geographic or rather geologic cause has, therefore been claimed and it is not impossible that it is connected with the relative purity of the water. Other investigations have shown that the content of the thyroid in iodin, is inverse to the distance from the ocean. Thus it is possible that sea foods, especially of a vegetable nature, may be of service in the treatment of hypothyroidism, and, conversely that they should be avoided in hyperthyroidism. This rule is certainly to be followed in the use of medicinal preparations of iodin in thyroid disease.

Intestinal toxaemia is unquestionably a factor in the exacerbation of exophthalmic goitre. The dietetic regimen need not be discussed here.

Otherwise, the dietetic management of thyroid diseases must meet particular indications.

The Parathyroids are now pretty well demonstrated to be independent glands and while they may be diseased at the same time as the thyroid, there is no necessary correlation between the lesions, either in the sense of parallelism or compensatory opposition. Partly by experiment on animals and partly by observation of lesions in human cases, it is believed that congenital myotonia is due to failure of development—analogous to cretinism—myotonos epilepsy and paralysis agitans to depressed secretion—analogous to myxoedema—while myasthenia gravis corresponds to exophthalmic goitre, being due to excess of secretion. Strumiprivic tetany is, by some, considered to be due to accidental removal of the parathyroids and not to loss of thyroid function. Lundborg claims favorable results from parathyroid extract in 9 of 11 cases of paralysis agitans.

The Pituitary Body seems to be a ductless gland and it is supposed that various lesions before the development of the skeleton cause gigantism and that an analogous change of function later, causes acromegaly. A contrast between deficient and excessive function has not been clearly made out though, from analogy, it is probable that nanism is the opposite of gigantism. Benda considers that pituitary extract is contraindicated in acromegaly, the latter being a condition of excess of function and explains the negative or even beneficial effects reported to be due to the fact that pituitary extract is neutralized in some way by the digestive juices.

Nothing definite is known of the function and diseases of the **Haemolymph Glands** so far as relates to dietetics and organotherapy.

Internal Secretions of Glands Having Ducts.

Diabetes is well established as a disease involving the Islands of Langerhans of the pancreas and it is generally regarded as consisting in the failure of the internal, glycolytic ferment secreted by these portions of the pancreas. Unfortunately there is, as yet, no practical realization of the theoretic treatment by administering such a ferment.

The relative fatness of castrated and spayed animals, of eunuchs and of many women after the natural or artificial establishment of the menopause, suggests that the testicles and ovaries have an internal secretion which controls the oxidation of fat. Extracts of these organs sometimes seem to have a beneficial influence in the rather vague senile changes occurring after the menopause or after the suspension of sexual function in men but their action is uncertain, particularly, in the treatment of obesity.

Extracts of kidney, liver and various other organs have been used empirically in the treatment of corresponding diseases but not with demonstrable benefit that could be distinctly attributed to the extract, and, on the contrary, sometimes with exacerbation of the disease.

The use of hydrochloric acid, pepsin, pancreatic ferments etc., may be mentioned as instances of organotherapy.

Subject to modification by further discoveries, the following general principles may be laid down in regard to organotherapy:

1. Providing an organ has no especial chemic ingredient, its anatomic correspondence to a human organ, gives it no special virtue in the nutrition of the healthy organ or the treatment of the diseased organ. Thus the use of lung to nourish or to heal lung and similar examples, are absurdities.

2. In so far as an organ or secretion contains chemic substances not contained in other parts of the body, or contained in other parts only to a slight degree, its use is logical to provide nourishment for the corresponding organ, or any other that may require the special substance in question. But, if this substance is not a ferment or if, being a ferment, its ferment function is destroyed in the method of preparation, as cooking, or in the course of digestion and absorption or if the substance requires material change by digestion before it can be assimilated, its action is purely nutritive and does not possess any conspicuous advantage over ordinary animal foods. For instance, it is logical to assume that the brain and spinal cord and even nerve trunks and ganglia administered as food or as properly prepared extracts, somewhat

facilitate the supply of special reconstructives to these organs. But it is absurd to imagine that they can have any direct therapeutic value in the treatment of diseases of these organs or that they can even materially increase intellectual and nerve function.

3. While chemic processes are included in the activity of all organs, we can distinguish pretty clearly (1) those whose function is mechanic, chemic manifestations being concerned only in the general nutrition and metabolism; (2) those whose function is physical in ridding the body of chemic substances not secreted in the organ itself or in supplying the body with substances not materially changed by the organ itself; (3) those whose function is to effect a decided chemic change in the material brought to them. The muscles, including the heart, and in a more recondite sense of discharging energy, the nervous organs are included in the first category. The dense supporting structures, bones, cartilage, ligaments, connective tissue conform even more closely to this conception of mechanic function.

The kidneys, sweat glands and lungs belong in the second category. The other glands, with or without ducts, perform strictly chemic functions though in some instances, as the liver, both physical excretion and true chemic activity are united.

As a general principle, it may be stated that organs performing purely mechanic and physical functions, cannot be benefited either in health or disease—excepting as mentioned under 2—by organotherapy. On the contrary, the use of an excreting organ or its extract is, in general directly harmful and especially so when its function is in any way embarrassed. But it must not be overlooked that these organs may possess functions not at present known so that properly prepared extracts, free from toxic waste substances, may ultimately prove of benefit.

4. The mere fact that an organ possesses a true chemic, secreting function is not an assurance that it or its extract will prove of value. To fulfill this condition, there must be some substance, usually a ferment, which performs some definitely useful function, which is not toxic to any decided degree, which can be

artificially introduced in efficient and harmless state. The liver, for instance, acts both as a ductless and a duct-discharging gland, bile contains both excreta and secreta, the bile pigments, although toxic excreta, are actually secreted by the liver, that is to say, they do not preexist in the blood but are manufactured by the liver. Obviously, we cannot stimulate the internal secretion of the liver by administering bile—nor by any other "extract" as yet discovered—and we should limit the attempt to supply bile to the use of the taurocholate and glycocholate salts.

5. Animal extracts should be very cautiously employed till it is proved that the condition under treatment is due to a deficiency and not to an excess of the substance in question. For example, exophthalmic goitre though undoubtedly due to thyroïd disease, is made worse by the use of thyroid extract, iodothyrin, or even iodin in other form.

6. They should also be employed cautiously until it is determined that as administered, they have no serious deleterious influence. (See discussion of adrenalin.)

7. Even when there is a demonstrable deficiency of a definite secretion, as the digestive ferments, there may be practical contraindications to the use of these substances. For instance, pepsin is very rarely indicated. If the stomach has any secretory activity at all, pepsin is usually present in the form of an undeveloped enzyme which can be perfected by the administration of a sufficient quantity of hydrochloric acid. If there is a genuine achylia, the stomach can be made to secrete by appropriate measures, if the achylia is functional; if the achylia is due to organic change, it is usually better not to attempt an artificial performance of its function but the food should either be predigested or reliance should be placed on pancreatic and intestinal digestion.

CHAPTER XXIX.

DISEASES OF THE LIVER.

While we have apparently, definite knowledge of the function of the liver in regard to glycogenesis, we are almost entirely ignorant of the function with regard to fats and proteids and practically unable, in any given case, to test the function of the liver, excepting with regard to its power to retain carbohydrates. Even the accumulation of empiric knowledge with regard to the effect of foods upon the liver, is tedious and uncertain. Thus, whatever is said in this chapter is largely hypothetic and many of the ideas regarding the subject are doubtless mere notions.

Biliousness is a term used vaguely and sometimes merely as a euphemism for constipation or even diarrhoea. Supposititiously, it signifies biliary torpor, with accumulation in the system of biliary waste. But, as it is not attended with the obvious retention of biliary pigment which is, at once, the most toxic and most conspicuous ingredient of the bile, this condition may not exist at all, and at any rate, it is impossible to justify the diagnosis in any given case. The writer has found it impossible to verify the apparent corroboration of this conception, by the supposed enlargement of the liver, most of the cases in which the liver has been stated to be enlarged, not yielding this sign on careful examination by palpation with allowance for the thickness of the abdominal wall, or by auscultatory percussion, or X-ray shadow. In most cases of so-called biliousness, indicanuria is found, along with other signs of intestinal putrefaction and it is obvious that the value of calomel and other cholagogues—which have been experimentally demonstrated not to increase the flow of bile—is easily explained on the hypothesis that so-called biliousness is an intestinal toxaemia.

Nearly every statement regarding "biliousness" can be transferred to the conception of intestinal toxaemia, viz., that it it due

to overeating, especially of rich, greasy foods, meats, crustaceans etc.; that malt liquors and strong alcoholic beverages should be avoided; that the bowels and stomach should be cleared out and that feeding should be intermitted for a day or two and should then be begun with eggs, milk if it does not disagree, fresh vegetables, cereals, juicy fruits and little meat and that of the simplest and most digestible kind.

Catarrhal Jaundice (cholangitis) is virtually an extension of a duodenitis. Abstention from food for a few days, with an abundance of water, especially alkaline water plain or carbonated is advisable, unless the patient is much reduced, when the nourishment appropriate to the next period should be instituted. This consists of peptonized milk, or junket, buttermilk, egg water, raw custard without liquor, beef juice, or the proprietary meat juices in certain cases. Fats should be reduced to a minimum and sugar should be used in small quantities after resuming solid food but too much meat should not be given. Cereals, stewed fruits without sugar or seeds, or even orange, lime, lemon and pine-apple juice may be given, and chicken breast, gelatin preparations or meat jellies, oyster stew without butter are appropriate.

In any serious lesion of the liver, there is usually the indication for abundant nutrition and the counterindication afforded by the impaired condition of the liver and the alimentary canal. The best compromise is the diet appropriate for chronic enteritis, with due regard to the gastric condition which is usually catarrh and hypochlorhydria.

Abscess of the liver is usually part of the morbid anatomy of pyaemia or a sequela of sepsis of the biliary ducts, incident to typhoid, paratyphoid and colon bacillus infection, or is due to haematogenic sepsis in the course of dysentery of different kinds. The prophylactic and therapeutic relations of diet are more or less susceptible of successful application, except that if hepatic abscess develops, treatment is usually unsuccessful.

Syphilitic, Tuberculous, Ecchinococcic, Leucocythaemic, Amyloid and similar lesions of the liver, may or may not interfere markedly with the hepatic function and the general digestive powers of the body. The ability to digest fats can be determined

to some degree by examination of the faeces, sometimes quite easily by macroscopic examination or extraction with gasoline which normally yields from a gram or two of faeces only enough fat to grease a sheet of toilet paper. Sugar digestion and assimilation can be judged crudely by the non-development or development of glycosuria (See Diabetes). The ability to utilize proteids must be determined by the state of gastric digestion, microscopic examination of the stools, urinary waste and symptomatology. No positive rules can be laid down for any serious lesion, with regard to any kind of foods but, usually a diet of milk, cereals, small quantities of tender fresh meats, proprietary foods, and stewed fruits or fresh fruit juices, may be employed and nutrition should be forced so far as possible in proportion to the digestive powers.

True **Fatty Metamorphosis** of the liver usually occurs as a fulminant process in phosphorus poisoning, as the result of toxaemia in pregnancy or without explanation, in yellow fever and occasionally in other infections. The regimen, is therefore that of yellow fever or other acute infection, or nil and the prognosis is so bad that the diet makes almost no difference in the result.

Feeding experiments resulting in the deposit in the liver and elsewhere of the specific fat employed, have cast considerable doubt on the former view of the distinction between fatty infiltration and metamorphosis and have led to the very practical but as yet undecided question as to the propriety of using appreciable quantities of fat when the liver is vulnerable.

Fatty Degeneration usually accompanies **Hepatic Sclerosis** and hence, from the yellowing tint produced, the more common term **Cirrhosis.** For practical purposes, we may distinguish (1) fatty changes accompanying marked interstitial changes—cirrhosis or sclerosis; (2) fatty infiltration, usually affecting various viscera, not causing especially marked functional disturbances and usually occurring as part of obesity; (3) non-fulminant fatty change hitherto considered as a true metamorphosis; and (4) fulminant fatty degeneration or icterus gravis. The first two will be diagnosed clinically as hepatic sclerosis and obesity, respectively and the dietetic reigmen and etiologic relations will be

discussed under those titles. The last has already been considered. The third is scarcely diagnosticable and is vaguely considered under the headings of cloudy swelling and degenerations under general pathologic changes.

Acute Hepatic Congestion is marked by rapid enlargement of the liver and febrile symptoms. It occurs after dietetic indiscretions, including the abuse of alcohol, during malarial fever, acute intestinal inflammation, and after chilling. In tropical countries, especially among foreigners, these causes are most likely to become effective.

Prophylaxis consists in an avoidance of the causes and, in general, in following not too rigidly, the dietetic and other customs of the tropics.

Treatment involves abstention from food for a few days or at most a restricted diet of milk, peptonized if necessary, cereals and fruit juice.

The most frequent liver disease of temperate climates is **Sclerosis or Cirrhosis.** The more frequent form consists in an overgrowth of connective tissue, resulting in contraction and in resistance to the portal circulation so that haemorrhoidal masses may develop in the oesophagus or stomach or intestine, from which haemorrhage may occur, either slight and dribbling, imitating the clinical picture of cancer of the stomach and bowel, or else copious, resembling that from gastric ulcer. Chronic catarrh of the stomach and intestine also results. Frequently, if the diagnosis is limited to conspicuous cases, rather infrequently and late in the course of the disease if it is recognized in its milder forms, ascites develops. In the dietetic management, it should be remembered that similar changes in the kidneys and pancreas are quite likely to be present and that the cirrhosis may be, not so much a local hepatic disease, as part of a general fibroid change including angiosclerosis.

The less common form of hepatic cirrhosis is hypertrophic, which may be, in some cases, a variety of the ordinary form in which the connective tissue increases more than it contracts. Other cases, to which the term hypertrophic cirrhosis is commonly but not so correctly applied, are due to inflammatory—mainly

infectious—processes extending up the biliary passages, with more or less consequent interstitial change. This form is more likely to be marked by jaundice and the ascites is less as are the other changes due to portal obstruction.

Hepatic cirrhosis is commonly described as a disease of alcoholics and the hypertrophic, biliary type is especially due to this cause. The writer's experience is that ordinary atrophic cirrhosis is quite common in total abstainers and that it may be merely part of the fibrosis of senility. Obviously, since most men drink alcoholic beverages to some degree, hepatic cirrhosis is usually found with an alcoholic history but, unless the use of alcohol has been considerable, other etiologic factors should be sought.

Fusel oil in poor whisky, spices, excess of salt, medicines taken for prolonged periods, food preservatives but, probably most important of all, products of fermentation and putrefaction in the alimentary canal, are to be considered among the causes of hepatic cirrhosis. Indican has been experimentally demonstrated to be a cause. Thus, almost any continued or repeated dietetic error or even the neglect of appropriate diet in mild forms of dyspepsia, may be considered as the cause of hepatic cirrhosis.

For many years, hepatic cirrhosis does not, as a rule, interfere conspicuously with hepatic function and, even in advanced cases, the disturbance of health seems to be directly ascribable to the gastro-enteric catarrh, and the development of a toxaemia from impairment of the excretory function of the liver or of its vaguely known function of modifying oxidation products, rather than to any obvious impairment of the function of modifying products of digestion. The mechanic effects of ascites are also important. Cases presenting glycosuria, and marked failure of digestive power, are frequently due directly to concomitant pancreatic lesion, not diagnosed.

Established hepatic cirrhosis is often marked by obesity, in the earlier stages, especially if fatty changes occur also in the liver. but by relative emaciation in the later stages. Anaemia is also present. Thus, in spite of the indication not to overburden either the liver or the system generally with toxins, the diet should include a moderate amount of meat but not viscera. The possibility

of favoring fatty changes in the liver by administering much fat has been mentioned. Thus, the diet should be maintained, if possible, at about the physiologic standard and relying mainly on cereals, legumes, milk, eggs and moderate quantities of meat.

Hard particles, large boluses of unmasticated food, spicy, or alcoholic or very hot ingesta should be avoided as tending either mechanically or by stimulating local blood supply, to cause rupture of varices. Strong tea and coffee are to be avoided, largely because of their effect upon blood pressure but also because of their tannin and the unfavorable action of caffeine upon the hepatic cells.

While somewhat dangerous on account of the chance of producing haemorrhage, especially when the blood supply to the stomach is already increased by the digestive reflex, considerable quantities of hot water with salt or soda, used some time before meals, tend to remove mucus and, by absorption, to wash impurities through the liver and ultimately out of the system by the kidneys. The beneficial effect of such use, is promptly seen. Lavage may also be practiced, with the same benefit and danger. This method is more efficacious and, on the other hand, while probably no more dangerous, the apparent responsibility of the physician in case of haemorrhage is greater.

Soft pulpy fruits are beneficial as laxatives and diuretics and they may have a truly cholagogue action. Grapes have been recommended as a "cure." Lemon and lime juices seem to have a stimulant effect upon the liver.

It will be noted that the diet is very similar to that for gastroenteric catarrh and, indeed, largely because of the almost inevitable existence of the latter condition.

The presence of ascites does not specifically influence the diet but, obviously, ascitic patients are mostly those with advanced cirrhosis so that there is more necessity for care, more frequently the demand for peptonized milk or other direct assistants of digestion and less probability of administering sufficient nourishment. The increase of abdominal tension renders the development of gases more noticeable and requires greater precautions against fermentation. The dietetic indications to relieve the dropsy

are also to be considered, and are mainly the same as in other forms. Too strict reduction of water must not be attempted and, as in other forms, the use of hot saline enemata may actually favor absorption by stimulating renal elimination.

Gall Stones are favored by infections of the gall bladder of rather moderate virulence, colon and typhoid bacilli being apparently the principal germs thus acting. Concentration of the bile, lack of exercise and possibly diet or metabolic conditions increasing the content of calcium or cholesterin as well as the lapse of considerable time, are other factors. For these reasons, they are to be expected especially in fat, over-fed and under-exercised, middle-aged or elderly women.

Dietetic prophylaxis consists in the use of a reasonable quantity of digestible food, with sufficient water, which should not be hard and the prophylaxis of alimentary saprophytosis, especially of the form consisting mainly in colon virulence with putrefaction of proteids, and the regimen suited to maintenance of vitality and prompt convalescence from typhoid, are also important factors.

It cannot be said that there is any satisfactory dietetic treatment of gall stones but a light milk-cereal diet, the use of alkaline waters and the moderate application of the grape or buttermilk cures, or similar methods to insure an abundant supply of water and salines, will usually prevent further deposits, secure drainage of the biliary passages, tend to reduce the frequently associated obesity and thus prepare the patient for simpler and safer operative measures, and allow more exercise to be taken.

CHAPTER XXX.

DISEASES OF THE PANCREAS.

Excepting diabetes, which it is rather premature to consider as invariably a pancreatic disease, the diseases of the pancreas are, for the most part, either so fulminant as to afford no basis for dietetic management except that appropriate to surgical cases, or so insidious that diagnosis is practically impossible. Hence, it is impossible to discuss them from the standpoint of demonstrated pathogeny and practical experience but merely from the theoretic.

It is altogether likely that purely functional disturbances of the pancreas exist—or at least as purely functional as for the stomach. Analogous to hyperchlorhydria, there may be an excessive secretion of alkalies, indeed the two conditions may coexist. It does not appear probable, however, that such a supersecretion of carbonates can ever cause corrosive lesions. It is plausible, however, that excessive gasseous distention of the bowel, without evidence of heightened fermentation, is due to the acid gastric juice decomposing this excess of alkaline carbonates, with production of carbon dioxid. In such cases it is logical to reduce to a minimum the ingestion of sodium—mainly in the form of salt—and of potassium, and of the organic acids, as in vinegar and acid fruits, which yield carbonates in the system. Precisely analogous indications exist in hyperchlorhydria which, as stated, may represent a corresponding overthrow of the chemic balance. The beneficial effects of out-door life in hyperchlorhydria, may also depend partly upon the increased elimination of carbon dioxid by the lungs.

Conversely, the vague depression of digestive power and of general nutrition in persons taking little salt and vegetables rich in organic acids and the forms of anaemia that are benefited by alkaline treatment, may indicate disturbance of pancreatico-enteric

digestion due to deficient alkaline secretion, quite analogous to hypochlorhydria.

As in the case of the stomach, nothing is known as to the diagnosis or effects of an increase of ferments nor as to whether such a quantitative increase is pathologic.

Although moderate depression of pancreatic secretion may be masked by the destruction of nutriment by bacteria in the bowel, the appearance in the faeces of notable amounts of soluble proteid or carbohydrate and especially of muscle nuclei, as well as the waste of excessive quantities of fat, undoubtedly indicates depression of the pancreatic secretion, provided that it cannot be accounted for otherwise. Individual differences in the utilization of nutriment and in the deposition of fat may also be due to the same fault. Especially in Addison's disease, but also in fevers, general malnutrition, medical and surgical shock etc., there may be emaciation on a liberal diet and even macroscopically, it may be evident that pancreatico-enteric digestion is imperfect.

If gastric digestion is normal or can be made so by artificial help, and the same evidences of lack of digestion appear in the faeces and in the general condition of the patient, pancreatic digestion may perhaps be assisted by administering pancreatin in salol-coated capsules. The general indication also exists to administer a simple, easily digested diet and to secure reflex stimulation of secretion by proper variety and appeal to the appetite, by thorough mastication and insalivation and by regular meals with proper rest during the first hour or two of digestion.

Since the pancreas digests all kinds of organic nutriment, no general line of selection can be followed, except to balance properly, the relative amounts of proteid, fat and carbohydrate, with special reference to the evidences of particular lack of digestive function manifested in the faeces and by the patient's appetite. Thus individual cravings or distastes for fat, sugar, starch, proteid, or rather for foods particularly rich in any of these, should usually be taken as valuable hints of digestive capability. Particularly in the case of children, should these hints be acted on unless obviously capricious.

While, in general, the proper performance of each stage of digestion, stimulates the secretion for the next stage, the fact that good nutrition can exist with a practically achylic stomach, shows that, if the achylia is permanent and not readily relieved, or if the attempt to restore gastric digestion by administering hydrochloric acid, is a failure, all our energies should be directed toward the pancreatico-enteric digestion and, in such cases, pancreatin may be administered and will probably not be spoiled by the stomach. Pancreatic predigestion is especially indicated in such cases.

Pancreatic lithiasis is rarely present and still less frequently diagnosed. It is always of alkaline type. It is obviously prevented, so far as possible, by the free use of water and by the use of meaty foods, hydrochloric and other mineral acids, benzoates and benzoic-acid containing vegetables, and the acidity of the urine may be considered the best available index to the administration of such substances, administering them if the urine is persistently of lower acidity than about 25 degrees. It may suffice merely to diminish fruits rich in vegetable acids which, by their decomposition into alkaline carbonates, tend to produce alkalinity of the body juices generally.

The general dietetic management of fibroid change and, especially of arterial sclerosis, with particular reference to prophylaxis, is also valuable in the way of tending to prevent not only pancreatic fibrosis but fulminant haemorrhagic lesions of the pancreas. In the management of hepatic sclerosis, it should be remembered that similar change is probably in progress in the pancreas.

The prophylaxis and treatment of obesity also tends to prevent the development of fat necrosis though, with the necessary pancreatic lesion and dissemination of the fat-splitting ferment, fat necrosis may occur even in the lean.

Malignant and other neoplastic lesions of the pancreas, septic, specific bacterial and parasitic lesions and traumatic lesions, are not amenable to direct dietetic rules but obviously require the use of a carefully regulated, easily digested diet, with assistance in the way of digestants and predigestion. As most of the more marked pancreatic diseases, aside from diabetes, are appropriate

for surgical intervention, the general principles of diet in such cases, are applicable.

It should be borne in mind that the tests of the faeces are not very reliable to exclude pancreatic failure but, if abnormalities are detected, and are not accounted for by gross dietetic errors or by intestinal lesions, they point with considerable probability to genuine impairment of pancreatic function. Even the fatty stools of biliary suppression or obstruction, are not as marked an exception as might be supposed. In the first place, the absence of biliary pigment gives, macroscopically, an exaggerated notion of the amount of fat present; in the second place, a real excess of fat is due mainly either to joint pancreatic obstruction or to true impairment of secretion.

CHAPTER XXXI.

DIGESTIVE ORGANS—MOUTH, TEETH, OESOPHAGUS.

In all dietaries, proper mastication and insalivation should be practiced, even milk requiring such admixture of saliva to insure against its coagulation in too large curds, and the food intended for introduction through a gastric or intestinal fistula, being more easily digested if thus prepared. Moreover, mastication and insalivation, in addition to their direct value in modifying the bolus to be swallowed, reflexly stimulate the inferior digestive juices.

The various functions fulfilled by mastication and insalivation are as follows: 1. The comminution and softening of food;

2. The introduction of ptyalin, of some though not great importance in the digestion of cooked starches;

3. More or less perfect insurance against accidental swallowing of foreign bodies, poisons and tainted or fermented foods;

4. Prevention of oesophageal and gastric neuroses such as hiccough, delayed peristalsis, spasm due to a dry bolus or one that is too large, air swallowing, spasm or relaxation of the cardia, etc.;

5. Diminution of the tendency to swallow undue quantities of liquid to wash down solid food;

6. Reflex stimulation, in advance, of the gastric and even pancreatic and intestinal secretions;

7. Satisfaction with reasonable quantities of food, the feeling of satiety not occurring if the food is hastily bolted, till an excess has been taken.

It is unwise to make a cult of chewing but the food should be masticated till it becomes almost tasteless, when deglutition will occur reflexly. This is the gist of the so-called Fletcher

method, which has been found by Prof. Irving Fisher to reduce the ingestion, especially of meats, and to increase the oeconomic utilization of ingesta so that the body is well nourished on considerably less than the ordinary excessive ration.

The alternate use of hot and cold ingesta tends to crack the enamel of the teeth and to produce catarrhal inflammation of the mouth, tongue, pharynx and even of the oesophagus and stomach. As in the case of corrosive poisoning, the protection of the oesophagus with dense, ropy mucus and the brief sojourn of the ingesta in this tube, may protect it although the stomach suffers.

The continuous use of ice held in the mouth, may produce stomatitis, especially glossitis, and hence increase the thirst for which the ice was prescribed.

The mouth and teeth should be cleaned or at least rinsed before eating—especially in fevers and in cases of gastro-intestinal fermentation or putrefaction, but also in health—to minimize the number of microroganism swallowed and after eating, to protect the teeth against caries. Neutral soap and water, waxed shoe-thread to remove particles between the teeth, soda and borax solutions for rinsing, are better than volatile organic or strong mineral antiseptics.

In various forms of stomatitis, especially with ulceration of the gums as in mercurial poisoning, or with gangrene as in noma, as well as in diphtheria and septic inflammations of the throat, parotitis etc., nutrition may be interfered with on account of the sensitiveness of the parts. In all such cases, the nourishment should be liquid or pultaceous, consisting mainly of milk, eggs and cereals, with expressed meat and fruit juices, if necessary. The diseased part should be cleansed and disinfected, using hydrogen peroxid or even strong antiseptics, before feeding. Occasionally, gavage may be easier for the patient as well as preventive of infection for the stomach.

In fracture of the jaw, after splinting, in tetanus etc., it may be mechanically impracticable to separate the teeth. If milk etc., can not be sucked through or behind the teeth, it may be necessary to pull one or two to allow the introduction of a tube or intubation may be practiced through the nose.

Various obstacles in the pharynx or oesophagus or abutting upon them, may prevent the swallowing of food. Spasmodic obstruction may usually be overcome by bougies and, while it may delay, it seldom prevents deglutition. Very rarely is oesophageal intubation required and still more rarely is the spasm sufficient to prevent the passage of a tube, especially if the bougie is first introduced.

Cicatricial obstruction, usually requires intermittent dilatation with bougies. Unless it develops as the immediate consequence of corrosion or ulceration, or the case has been neglected, the oesophagus will usually allow at least the passage of liquids.

Oesophageal dilatation and diverticula, present many individual peculiarities. They do not usually prevent swallowing although they may delay it and may call for the use of bougies, and tubes. In some cases tubes may be permanently retained, issuing either from the mouth or nose, or reaching only to the pharynx, being retained by a thread or other device.

Syphilitic obstructions usually yield promptly enough to general medication so that by using liquids or by intubating or dilating, gastrostomy is unnecessary. Tuberculous, other ulcerative and inflammatory, including corrosive lesions, are less certainly relieved.

When the malignant nature of an oesophageal obstruction has been pretty positively established, further instrumentation should be avoided as tending to stimulate growth. In the majority of cases, radical operation is impossible. In a surprisingly large number, liquid or even semi-solid food can be swallowed to the end. Purpetrol (pure mineral oil, not the ordinary commercial products used by laryngologists) is of value as a lubricant for the passage of food.

Instrumentation in obstruction due to aneurysm is especially to be avoided, on account of the conspicuously prompt result of rupture and the equally marked responsibility of the physician, rather than because of the mathematic probability of rupture by a blunt bougie or soft tube.

A malignant or other obstruction which is absolute or practically so requires prompt decision on the part of physician and pa-

tient, syphilis alone offering any reasonable hope of sufficiently speedy relief of an obstruction of a degree threatening death by starvation. Radical local operation should first be considered but, even so, gastrostomy is often indicated as a preliminary to build up the patient's strength. If the patient is in a hopeless condition on account of old age, or disease or if the obstruction is a rapidly growing malignant tumor or advanced aneurysm, it is better to maintain life as long as possible—usually not more than 40 days dating from the time at which nutrition becomes seriously impaired—by rectal and hypodermic nutrition and inunction. In cases in which there is no immediate danger of death except on account of the imminence of starvation—including slowly growing malignant tumors—a gastric or superior intestinal fistula should be made. If the stomach is not invaded by the growth and is otherwise in fairly good functional power, the former should be preferred, otherwise the latter, in spite of the trouble from digestion of tissues by escape of activated pancreatic ferments. (See special discussion of fistulae.)

CHAPTER XXXII.

DIGESTIVE ORGANS—STOMACH.

The facility and exactitude with which the functions of the stomach can be tested, as compared with those of other organs except the kidneys and heart, and the influence which improper performance of the gastric function has upon intestinal digestion, render it almost imperative to treat gastric diseases upon the basis of definite knowledge and not guess work. However, intubation is useless unless the gastric contents can be obtained undiluted or, at least, with dilution of definite degree, and unless the physician is prepared to examine them. It is also dangerous in gastric ulcer of acute type, in aneurysm, advanced angiosclerosis and many other conditions. Much can be learned from investigation of vomited material, attention to the eructation or presence of gas, mapping out of the gastric area etc.

Acute indigestion is a fallacious term. Transitory failure of digestion probably usually does not come to the physician's attention. As commonly used, the term usually covers some different condition, as sub-acute inflammation of the appendix or colon, an analogous condition of the gall bladder, a reflex disturbance from movable kidney, pelvic inflammation etc. In the form of sick headache, it is often due to eye strain, especially from using the eyes on a bright day from a moving and oscillating vehicle, as a train, trolley, automobile etc., or else is a manifestation of poisoning with products of decomposition as mild tyrotoxicon formation in milk etc. Vomiting, which is frequently spontaneous is, therefore, conservative. In all such cases, while there may literally be an indigestion, this is not the prime condition. Dietetic treatment should be negative—the withholding of food for a day or so.

Starch and fat indigestion are also misnomers as commonly applied to gastric disturbances. While digestion of starches by ptyalin in the stomach continues for the first hour or so, before

the acidity has risen to a degree at which ptyalin is inhibited, and while careful mastication and insalivation may allow considerable starch to be thus converted into maltose, ordinary habits of eating by healthy adults do not usually allow any considerable quantity of starch to be thus digested. So long as the starch does not ferment, reliance may be placed upon the amylolytic action of the pancreas and the subsequent inversion by the intestinal ferment. Unless there is stagnation in the stomach, the inevitable starch indigestion in hyperchlorhydria gives no particular trouble. So-called starch indigestion is usually carbohydrate fermentation and occurs by preference in hypochlorhydria in which there is literally, more opportunity for starch digestion in the stomach, than normal.

Fats are never digested in the stomach to a degree appreciable by ordinary tests. Thus, so-called fat indigestion, merely refers to rancidity of fats caused by microorganisms and is usually concomitant with putrefaction of proteids.

Gastric Saprophytosis. Normally, hydrochloric acid and the relatively brief duration of gastric digestion, prevent any conspicuous degree of activity of microorganisms in the stomach. Moreover, the stomach normally becomes nearly sterile in its resting periods. Thus stomach contents, whether after a meal or consisting of the jejune juices, contain fewer bacteria by far than the mouth or intestine, under ordinary conditions. Hpyerchlorhydria, unless complicated with ischochymia, or unless occurring as an occasional, transitory condition, is incompatible with any marked degree of saprophytosis, either consisting of fermentation of carbohydrates, rancidity of fats or putrefaction of proteids and other nitrogenous foods, providing that such changes are not already in progress when they are ingested.

Any condition that tends either to depress hydrochloric acidity, directly to interfere with digestion, or to cause stagnation in the stomach, tends to cause gastric saprophytosis. Sometimes one, sometimes all of these factors are operative, and there is not always a direct correspondence of potential cause and actual effect. Usually, gastric saprophytosis is limited mainly to fermentation

of carbohydrates. Notable rancidity of fats and putrefaction of proteids and other nitrogenous foods usually occur together and only when there is marked failure of hydrochloric acid as well as protracted stagnation—hence mainly in cancer or when, for some reason, intestinal bacteria have invaded the stomach, as after gastro-enterostomy or during intestinal obstruction more or less absolute.

In all forms of gastric saprophytosis, there is an indication to limit the food stuffs attacked by saprophytes, even to the degree of keeping the stomach entirely free from food for a few days but there is an obvious nutritional contraindication to reducing any or all kinds of organic foods for any considerable period. Thus, in the ordinary form, consisting in fermentation of carbohydrates, it is well to limit the starches and sugars to some degree, fats can almost always be eliminated from the diet for any length of time, and meats and eggs whose proteids are most prone to putrefaction, may be dispensed with for some time.

The real indications, however, are to restore gastric motility and secretion, if possible; to administer foods recently sterilized by heat rather than raw foods and to avoid foods, however well sterilized, in which saprophytic changes have already begun; to use actual antiseptics, in addition to the hydrochloric acid implied in the first indication since certain antiseptics are relatively efficient, in spite of the scepticism bred by test tube experiments; to keep the mouth and throat as nearly aseptic as possible—and conservative or dêstructive and constructive dentistry must not be forgotten in this connexion—to keep the stomach also relatively aseptic by lavage or at least the use of hot water before meals; and to diminish intestinal saprophytosis by appropriate means.

In mild cases, it suffices to avoid gross dietetic errors and to maintain hydrochloric acidity. In others, more severe but mainly limited to carbodydrate fermentation, a meat, egg or milk diet may be pursued for a few days. Again, the best diet is of cereals with small quantities of meat, milk and eggs and fruit juices. So long as nothing is done to restore gastric function, it is too apt to follow that the more the diet is reduced, the more it

has to be. It is a general principle that certain strains of bacteria become increased in virulence by constant use of the same pabulum. Thus a radical change in diet is usually indicated.

Milk is especially apt to cause trouble hence, particularly in infants, temporary change to some substitute food as already mentioned under dietetics of infancy, or even to another kind of milk, as goat's milk, is often indicated. In adults, milk may usually be suspended altogether.

In the more serious and often cancerous conditions, attended with rancidity and putrefaction, a diet consisting mainly of cereals and of soft, well masticated or chopped green vegetables, such as peas, green beans etc., and fruit, in moderate quantities, even with considerable amounts of sugar to supply energy, often works well.

Functional Gastric Disorders. It is extremely difficult to distinguish between functional and organic gastric disease, not in the recondite sense that any functional disorder is probably attended by an actual but inappreciable lesion, but with allusion to the difficulty of diagnosing slight organic lesions that would be perfectly apparent, even macroscopically and certainly microscopically, if the stomach could be exposed for examination.

On the one hand, not exactly normally but practically inevitably, there are always slight inflammatory or degenerative processes going on in the gastric wall as the result of mechanic, thermic, bacterial, and chemic insults incident to ordinary habits of eating and drinking as well as waste and repair of tissue, including the shedding of epithelium. On the other hand, pathologic lesions, unless of considerable extent or severity, do not manifest themselves readily. Hence, the functional terms are retained only as a matter of convenience, for immediate therapeutic purposes.

As a rule, hypochlorhydric states are attended by sluggish motility, hyperchlorhydric by excessive motility but the latter may be and often are complicated by, if not induced by obstruction at the pylorus so that the excess of motility is unavailing and a state of stagnation exists. Later, the continued resistance to peristalsis causes motor failure, even degeneration of muscle and dilatation.

In **Hypochlorhydria,** in addition to the indication for hydrochloric acid, sodium chlorid, from which the acid is formed should be used freely, yet not excessively, since its presence in the stomach in too great a proportion, checks digestion.

The diet should be reasonably varied, to stimulate secretion reflexly through the appetite, but should exclude coarse vegetables, pastry—though there is usually no objection to the inside of good pies or even to the upper crust, if light and not too "short"—; fried foods should be used cautiously though a little fried bacon or ham or egg may usually be taken without harm. Fruit should be used moderately. Milk may be employed if well mixed with cereals etc. Tea and coffee should be taken weak, if at all, and comparatively little water should be used with meals. Three or four hours after meals, water should be drunk at intervals, so as to administer 200 or 300 c.c. three times a day. There is a difference of opinion as to nuts, seedy fruits and vegetables rich in cellulose. On the one hand, the hard particles and shreds of indigestible material tend to stimulate secretion and peristalsis; on the other hand, they may remain too long in the stomach and favor bacterial activity, gas production, exhaustion of muscle and hence the production of catarrh and dilataion. This difference of opinion is doubtless due to difference of result in different cases, so that the decision must depend upon empiricism in the individual case.

A very important principle, corroborated by Pawlow but long known, is that each food tends to stimulate the secretion needed for its digestion and to inhibit those not needed. Hence, fats and carbohydrates should be reduced to or below the ordinary standard minimum while proteids especially meats, should be given in relatively large amount, 100—150 grams (corresponding to 1—1½ pounds of meat) a day.

Hyperchlorhydria occurs much less frequently than hypochlorhydria (the former in 10—20% of a miscellaneous series of gastric cases) its symptomatology is very closely imitated in inflammation of the appendix, gall stones, cholecystitis and even by neuralgia or neuritis of the somach itself, some other viscus or the body wall. Nine-tenths of cases of acute "sour stomach"

are hypochlorhydric with formation of vegetable acids. Even when the stomach contents are analysed, the hydrochloric acidity is often exaggerated ten or fifteen degrees by reading the acidity at the final discharge of color from dimethyl-amido-azo-benzol instead of at the change from cherry to orange. Thus a very false impression has arisen as to the frequency of hyperchlorhydria.

Hyperchlorhydria should not be diagnosed unless the hydrochloric acidity is more than 50 degrees with small quantities of chyme or at least 40 degrees if the stomach contents are approximately equal to or in excess of the amount ingested.

The dietetic indications are almost exactly opposite to those for hypochlorhydria and, while drugs may be of benefit to relieve pain or to depress secretion, the essential treatment is dietetic, at least if alkalies are included as articles of diet. Excluding ischochymic cases with lesion at the pylorus, this treatment is curative in the immediate sense and, barring a rather marked tendency to recurrence, even in the ultimate sense.

Sodium chlorid should be restricted as much as possible.

Spices, condiments and sapid foods should be interdicted.

Proteids are theoretically indicated to combine with HCl, contraindicated on account of their tendency to excite further secretion. Frequent meals are indicated to keep the gastric juice at work on ingesta rather than on the stomach, contraindicated because they call forth more secretion. Continuous supersecretion (known by the etymologic horror, gastrosucorrhoea) is now generally held to indicate actual ulcer. Unless, as in ischochymia with hyperchlorhydria, there is a tendency to saprophytosis, fats and sugars should be given freely as they tend to reduce the secretion, in accordance with the general principle already enunciated.

These various indications and contraindications are met by excluding meats, especially viscera, but by allowing a rather liberal use of milk, eggs, custards, cereals, on account of their proteid, fat meat, cream, starchy vegetables such as potatoes, sweet potatoes and bananas, juicy fruits free from seeds, core and skin, and considerable sugar and syrup.

Tea and coffee should not be allowed but weak cocoa with milk and sugar may be used. Cold, even ice water, or cold saccharine but not alcoholic nor carbonated drinks, are advantageously used at the time when gastralgia indicates the appearance of a high degree of acidity, usually 1—2 hours after meals. It should be remembered that unless a true hydrochloric acid excess has actually been demonstrated, the symptoms may be misleading. The relative excess of secretion from the stomach renders the chyme abnormally liquid, so that little or no fluid should be taken with the meal.

In the administration of alkalies, it should be remembered that, in general, an acid or alkali tends to reduce a secretion of its own reaction and to increase one of the opposite reaction, if given before the normal time of secretion but that we can usually count on this rule working when we do not wish it to and vice versa. Hence, neither acids nor alkalies should be given before meals but alkalies should be given 1—3 hours after meals, often in several doses. Magnesium oxid, hydroxid and lime water are the best. Carbonates should not be given on account of the stimulation of the mucosa by bubbles of carbon dioxid gas.

Hyperchlorhydria does not manifest any marked tendency, as commonly taught, to eventuate in ulcer but still this possibility must be borne in mind. It is commonly stated that the gastralgia of hyperchlorhydria is relieved by eating, and that of ulcer made worse. This is not a positive rule, either way. Hyperchlorhydric gastralgia does not usually develop on an empty stomach, i. e., the secretion does not begin till food is taken, unless too long a time is allowed to elapse between meals. It usually develops 1—3 hours after a meal and while it may usually be relieved by taking more food at this time, there is an objection to superimposing one meal upon another not yet fully removed from the stomach, so that it is better to relieve the pain by water or alkalies. Continuous acid secretion has been demonstrated to occur almost invariably as a result of gastric ulcer.

The time at which pain begins after the stomach may be considered or has been demonstrated to have emptied itself, is a guide to the frequency of meals. Many patients do well with three,

a few with two meals a day. If, four or five hours after a meal the pain begins again, it is an indication for another meal. Rarely is it advisable to feed oftener than five times daily. All of the meals should be rather hearty, since a light meal stimulates acid secretion almost as much as a full one and does not sufficiently absorb the acid secreted. In most of these patients, leanness exists so that there is no marked contraindication to overnourishment.

As a rule, one should go to one extreme or other in feeding. In certain cases in which ulcer is feared or known to exist, or in which each meal serves to excite secretion and does not properly neutralize it, the opposite plan of physiologic rest for the stomach should be instituted, giving both food and water by the bowel or subcutaneously, for several days, up to a week or two. Not even water should be allowed by the stomach except enough to wash down bismuth and the alkalies mentioned, which may be given at the same time.

Gastric atony and **hypertony** are often mentioned as independent neuroses and they do occasionally occur apart from corresponding secretory abnormalities. The diet appropriate for atony has been described. It is questionable whether the too rapid passage of food through the stomach does any harm, except by occasionally frustrating attempts to secure gastric contents for examination. At any rate, the dietetic treatment of hypertony is a difficult problem. Mere increase of the size of the meal usually causes sufficient delay for the abstraction of a test meal but there are obvious contraindications to the routine increase of ingesta. Moreover, if we attempt to increase the bulk without increasing the nutritive value of food, the hypertony frequently causes exactly the reverse result to that desired, the indigestible residue which tends to remain in the stomach in atonic states, often stimulating gastric peristalsis in hypertonic states.

Acute Gastritis of the grade produced by irritant poisons, and very hot water—which is rarely swallowed by a conscious person in sufficient amount to injure the stomach—requires, after the appropriate treatment of the poisoning, physiologic rest of

the stomach for several days. Mucilaginous drinks, with antiseptics, alkalies and bismuth, may be employed and rectal nutrition or, at least, the administration of saline solutions, may be necessary.

Subacute Gastritis, of the grade produced by alcohol, overloading the stomach with indigestible or tainted food, occasionally by "taking cold," especially when the circulation is already impaired by hepatic sclerosis, or due to endogenic poisons, requires purgative treatment and rest of the stomach for one to several days.

The after treatment of these two conditions is the same but is begun after a delay proportionate to the severity of the inflammation. At first, peptonized milk, then the milk-cereal diet appropriate to fevers, is used. After a week or two, a bland, easily digested, ordinary diet is instituted and it may be necessary to avoid pastry, fried foods, coarse vegetables etc., for a month. Digestants may be used as indicated—remembering the superiority of the vegetable digestants over pepsin—but it is usually wise not to attempt to restore hydrochloric acidity for two or three weeks, since its abeyance is conservative.

Chronic Gastritis, without dilatation, marked atony or mucus excess, is to be treated according to the state of the secretion, mainly hypochlorhydria. If there is much mucus—and the normal oesophageal mucus must be discounted—it should be removed by lavage or by drinking a glassful of hot water containing 1—2% of sodium bicarbonate and borax, $\frac{1}{2}$—1 hour before meals. Or 5—20 c.c. of hydrogen peroxid or some analogous preparation, may be used but this often causes vomiting, although it does not seem to produce any lesion of the mucosa.

The food should be practically sterile, as by recent cooking, and while hot biscuits, pan cakes, waffles etc., and even fresh bread are liable to become doughy masses in the stomach, it is well to toast crackers and stale bread. By the way, the word stale as applied to bread stuffs in dietetics, does not imply the beginning of putrefactive or fermentative changes but merely partial drying so that the freshness and tendency to resume the doughy consistence on chewing, have been lost. The food should be bland, nutritious and relatively concentrated, though gastro-intestinal

atony is relieved by the use of legumes, tender, finely cut lettuce, creamed cauliflower, boiled and well masticated onions etc., in moderation, of fruit etc. It is a safe rule never to allow any one meal to exceed a quart in total bulk and a pint is the ordinary limit.

The administration of water or other liquids with the meal is a moot point. On account of the general tendency in chronic gastritis to scanty, viscid secretion, it would seem that a moderate quantity of water, say a glassful (200 c.c.) should be allowed at meal time.

Conditions Causing Gastric Stagnation.

1. Gastric atony, a simple fault of innervation, often accompanied by paretic constipation and usually by hypochlorhydria.

2. Degenerations of the gastric muscle, not sharply distinguishable clinically from atony, due to infections, hyperpyrexia, endogenic and exogenic chronic intoxications, malnutrition, local or general.

3. Vertical stomach, a developmental condition usually found in slender waisted women, usually accompanied by movable kidney and general visceral inadequacy, sometimes by more or less general splanchnoptosis. In this condition, there is a primary tendency to too rapid discharge of the stomach contents into the bowel but the rather acute angle between the axis of the stomach and of the first part of the duodenum tends, sooner or later, to cause delay of stomach contents or even a dilatation of the lowest part of the stomach.

4. Gastroptosis. A. Of mild type, the axis of the stomach approaching the horizontal with tendency to atony and true dilatation. (Note. There is a very general tendency to confuse dilatation and ptosis. Although having many etiologic, symptomatic and therapeutic points in common, it should be remembered that ptosis means the sagging of a whole organ, dilatation the enlargement and hence, as referred to a hollow organ, the sagging of the lower portion only.)

4. B. Gastroptosis of severe type, the stomach being banana-shaped, with the convexity downward, and occupying a position at or even below the umbilical equator.

5. Atonic dilatation, the logical result of any of the preceding conditions, the stomach being moderately enlarged and relaxed, but with no obstruction at the pylorus.

6. Obstructive dilatation, due to pyloric cancer or other tumor, cicatrizing ulcer or an open ulcer or fissure the passage of food over which causes marked tonic spasm, pressure by peritoneal bands or growths of various kinds exterior to the stomach. Gastroptosis, especially of type B., may cause sufficient angulation to produce organic obstruction. In obstructive lesions, there is a primary tendency, more or less adequate, toward compensatory hypertrophy of the muscular coat so that, especially if diet is carefully regulated and other appropriate treatment instituted, dilatation may not develop. However, practically all cases of marked gastric dilatation are due to obstruction of some kind, at or near the pylorus. Obviously, in spite of tables of differential diagnosis, gastric dilatation is usually complicated with catarrh, and by various other functional and organic conditions.

It is highly important to know, not only the motor state and size and position of the stomach in this group of cases but also the secretory and digestive function and the actual organic lesion present, if any. Gastroptosis of type B. is liable to be complicated by stretching and partial compression of the oesophagus, with dilatation above the cardia, where food and mucus may accumulate so as to require occasional lavage of the lower oesophagus and even gavage through a tube. Otherwise, the dietetic management of the first 5 conditions of this group is about the same, and has already been discussed.

Marked dilatation of the stomach is a condition to be diagnosed *with* rather than *from* other gastric diseases. For dietetic purposes, it may be divided into the following types which, however, are not entirely distinct and which are subject to modification during the progress of any individual case.

A. Dilated, catarrhal stomachs, with depressed hydrochloric acidity, moderate stagnation and fermentation. The food should be concentrated, so as to administer an adequate ration in three or even two meals a day, with long periods of rest. Indigestible residue and hard or chaffy particles, or unmasticated soft portions should be avoided, in order to facilitate the passage of food through the pylorus. Antiseptics, digestants and hydrochloric acid should be used p. r. n. Water should be given three to five hours after meals to aid in washing remnants through the pylorus and lavage may also be practiced at this time, but usually not oftener than once a day. If there is much mucus, hot water with soda and borax or hydrogen peroxid etc., may be administered before meals, as already mentioned for chronic gastritis.

B. Ischochymia, mainly due to ulcer at or near the pylorus with hyperchlorhydria and, on account of the stagnation, a paradoxic occurrence of fermentation, mainly of carbohydrates in spite of the antiseptic action of the acid. The hyperchlorhydria acts in a vicious circle to maintain the ulcer and the pyloric spasm. In these cases, intermittent physiologic rest of the stomach should be practiced, with rectal and hypodermic alimentation for a week or two at a time, to secure contraction of the stomach, healing of the ulcer and asepsis. While fed by the stomach, the meals should be as small and as far apart as possible, should be pultaceous and unirritating and, at the same time should be low in carbohydrates. On account of the hyperchlorhydria, there is an indication to reduce proteids also but this is balanced by the need of nutriment. On the whole, the best diet consists of milk combined with wheat cereals of a soft nature when moist, and with some egg, well comminuted, and expressed meat juice. Non-effervescent alkalies and antiseptics are usually needed. Lavage late after meals is usually required. Purpetrol may facilitate the passage of food through the pylorus.

C. Dilatation due to cancer at the pylorus, with depression of hydrochloric acid secretion, marked lactic acid fermentation, and putrefaction of proteids, including perhaps the cancer itself,

and rancidity of fats when cancer has advanced to this stage. While there is a theoretic indication to establish and feed through a superior enterostomy, life can seldom be prolonged sufficiently to make this operation worth while. The dietetic indication is to cleanse the stomach thoroughly and nourish as well and as long as possible by the bowel and by hypodermic injection, inunction etc. When the rectum becomes intolerant, peptonized milk, cereal gruels etc., with digestants and antiseptics may be employed for a few days, practicing lavage every day or two late after a meal. In these cases, water may usually be supplied by the stomach throughout both periods. When the stomach becomes markedly intolerant, rectal alimentation may be resumed and this alternation may be repeated several times before death occurs. The stomach and rectum should not both be used at once.

D. Water-tight closure of the pylorus. This may be diagnosed by the non-appearance of charcoal, berry juice, peppermint or, better yet, purpetrol, in the faeces. It occurs mainly in cancer of the pylorus or, at any rate, this is the only condition—barring extremely depressed general states—in which immediate operation of a radical nature should not be insisted on. Even cancerous obstruction to this degree, unless as a final stage of type C, is usually due to a slowly growing scirrhus mass and should be considered to indicate radical operation or if that is not feasible, the establishment of a superior enterostomy. Some surgeons advise gastrostomy plus gastroenterostomy which, of course, should not be allowed unless there is some peculiar contraindication to superior enterostomy.

Granting that operation has been set aside, we have, in addition to the meagre assistance of hypodermic nutrition and inunction the choice of introducting nutriment for a short distance into either the upper or the lower end of the alimentary canal and, for physiologic reasons neither method is efficient. Excepting the small quantities of fat present in milk and other selected foods, the entire fat ration, say 60 grams of cocoanut butter—which is softer and apparently better absorbed than cacao butter—should be introduced by inunction daily. Peptonized milk, dextrose

and perhaps cereal gruels and white of egg and milk with digestants should be used for gastric feeding, in amounts as nearly as possible approaching the standard minimum ration or about 1500 calories, should be given in two or three daily feedings. Minute feedings with various liquid foods will give a false sense of satisfaction but fermentation and usually putrefaction will occur and vomiting will necessarily ensue after a few days at most, unless the patient is so much depressed that even this conservative reflex is absent. Lavage must be practiced every day or two. As in the previous type, an alternation of rectal and gastric nutrition must be followed.

So-called **Idiopathic Hypertrophy of the Pylorus** occurs mainly in infants. It is scarcely amenable to dietetic treatment, since the food is already as bland and soft as possible. However, before resorting to operation, the maternal milk or substitute should be examined with reference to curdling in large masses and a brief change to some prepared, non-starchy food, to white of egg water etc., and lavage of stagnated food, may be practiced.

Microgastria develops from prolonged lack of appetite, as from solitary life or eating in unpleasant surroundings, from ulcer or various other painful gastric conditions or from fibroid degeneration of the stomach without tendencies to cause dilatation. Antipathy to water, without addiction to other beverages also causes it. Once established, a vicious cycle exists. The primary indication is to administer food as concentrated as possible, to aid digestion and to increase the frequency of meals. Water should be given three or four hours after meals. Later, the endeavor should be made to stimulate the appetite by change of environment and general hygienic measures and gradually to increase the bulk of food so as to enlarge the stomach. Unfortunately, many cases coexist with anadenia.

Gastric Cancer interferes with digestion and requires dietetic management for the following reasons:

1. Prevention of entry of food through the cardia.

2. Prevention of exit of chyme through the pylorus.

3. Infiltration or weighting of the gastric wall, preventing proper motility.

4. Early and rather infrequent stimulation of motility or secretion or both, by irritation. A few cases of hyperchlorhydria subsequently prove to be cancerous. It is difficult, however, to establish the date at which the cancer begins and many such cases are probably primarily of ulcer with hyperchlorhydria, the ulcer later becoming cancerous.

5. Usually and practically always ultimately, depression of motion or secretion or both by general asthenia or local repression of function. While cancer almost always produces hypo- or achlorhydria in advanced stages, it should be remembered that the great majority of hypochlorhydric cases are not cancerous. This fact renders the prompt diagnosis of cancer exceedingly difficult.

6. On account of the depression of secretion, interference with motility and obstruction at the pylorus, saprophytosis is favored. Lactic acid fermentation has been considered pathognomic of cancer but it always occurs to some degree under ordinary diet and it is, at most, diagnostic of stagnation which, in extreme degree and with other circumstances favoring saprophytosis, is usually due to cancer.

7. After the cancer has become exposed, ulceration due to digestion or gangrene develops, according to the relative strength of secretion, the failure of nutrition of the mass and the development of proteolytic bacteria.

Etiologically considered, cancer has been ascribed to the excessive consumption of meat, of raw vegetables conveying the putative germs of cancer, of salt, of raw eggs implanting living epithelial cells, and from the local standpoint, of various dietetic errors unduly fatiguing the stomach, causing chemic irritation by products of fermentation, mechanic irritation by foreign bodies and dense masses swallowed, or indirectly favoring hyperchlorhydria and ulcer which subsequently becomes cancerous. None

of these factors has any practical bearing in a statistic sense, although the local one may have some influence.

In the early stage, cancer is scarcely diagnosticable and, if it were, no particular dietetic indication is present. The indications for operation requiring feeding by fistulae and the indications derived from the various mechanic, digestive and saprophytic complications have been discussed under appropriate headings. It may be emphasized that, unless the tumor involves nervous structures, pain and discomfort are largely amenable to dietetic management. The ordinary painful gastric cancer is so mainly because the stomach contents are allowed to remain in an excessively acid state, rarely on account of hyperchlorhydria, usually on account of fermentative acidity. The dietetic management described and lavage, will almost entirely relieve this pain.

In hopeless cases—in the immediate sense—any kind of dietetic indiscretion which the patient desires may be allowable, even including abstinence from food, controlling vomiting and pain by various narcotics, including morphine.

Gastric Ulcer, for dietetic purposes, may be divided into two groups: 1. Acute peptic, traumatic, including operative, and acute infectious ulcer, as during the exanthemata, in which danger of haemorrhage, perforation or at least of increased local lesion, is imminent; 2. Chronic angiosclerotic, embolic, cancerous, syphilitic, tuberculous ulcer, in which haemorrhage is not likely to be of serious degree, except by inducing gradual anaemia and in which the danger of perforation is minimized by cicatrization and adhesions. Back pressure haemorrhage, mainly due to hepatic sclerosis, may imitate either type of ulcer and calls for dietetic management accordingly.

Excepting the acute peptic type, most gastric ulcers are associated with hypochlorhydria. Peptic ulcer, though probably mainly due to the action of a strongly acid gastric juice on tissues whose nourishment is markedly reduced by angiospasm, direct neurotrophic or other cause, is not invariably due to actual hyperchlorhydria and, after its establishment, the acidity is frequently reduced. It must be remembered that there is a contraindication to the use of the stomach tube in such cases and that the common

belief in the presence of hyperchlorhydria rests on very meagre and often fallacious evidence.

The acute type of gastric ulcer requires as nearly as possible absolute rest, local and general. It is folly to administer ordinary styptics, though adrenalin and possibly hydrogen peroxid may be allowed, and lumps of ice soon become lukewarm water in the stomach and actually favor haemorrhage. Both food and water should be administered by the bowel or hypodermically for at least a week.

Lenharz, of Hamburg, has advocated the early resumption of gastric nutrition, and has laid down an elaborate and arbitrary schedule of feeding with eggs and milk. The general principle may be enunciated that feeding should be recommenced as early as it is safe to do so. If there has been no evidence of repeated severe haemorrhage and the vomitus, if any, and the stools are free from blood at the end of a week, about 200 c.c. of peptonized milk may be given. After this, it is well to wait a couple of days, to see whether fresh blood appears in the stools. If it does, rectal nutrition should be continued for three or four days longer. If not, the peptonized milk should be continued for three or four days. Then the white of an egg may be added to each feeding, and, a week or so after the resumption of gastric feeding, six entire eggs and a liter of milk, representing about 1,200 calories, may be given daily. In the second week, soft cereals may be added and peptonization may be omitted, unless there are signs of gastric distress. By the end of the second week the patient may take a full ration of eggs, cereals and milk, unless haemorrhage indicates the suspension of feeding. After a month, ordinary food may be taken, but dietetic errors of all kinds should be avoided for several months, and the diet should be very simple.

It is unwise to use meat, or any meat preparation containing blood for the first two weeks, at least, on account of confusion in applying the blood test to the faeces.

Achylia Gastrica probably often occurs from reflex inhibition during asthmatic attacks, acute fevers, from traumatic or surgical shock, fear etc. Suspension of feeding is indicated, though hot beef tea or strong coffee may be given as a stimulant. Hypochylia

doubtless occurs in all depressed states and calls for predigestion or administration of vegetable digestants.

Persistent achylia gastrica occurs sometimes in Addison's disease, and as a terminal process in many serious conditions, including gastric cancer. It necessarily occurs in anadenia, the final degenerative stage of chronic gastritis which, however, does not usually reach this stage. Sometimes it is unexpectedly discovered in patients otherwise in good health and well nourished. On the other hand, it is rather characteristic of pernicious anaemia though the association is not regular.

Such cases should, at first, be treated with the hope of restoring gastric function, using easily digested food, including sapid tender meats, cereals, well salted eggs, etc., and eliminating coarse vegetables, tea, coffee, alcoholics etc. Hydrochloric acid and perhaps vegetable ferments should also be given.

If it appears that the achylia gastrica is permanent, the aim should be to secure proper intestinal digestion. The food should be simple and should be well masticated and insalivated. It is a moot point whether hydrochloric acid should be continued to imitate the normal condition by which the inferior digestive secretions are supposed to be stimulated, or whether the case should rest in statu quo, on the ground that the system has become habituated to the omission of gastric digestion and the effect of this upon intestinal digestion. When the latter also fails, the outlook is exceedingly unfavorable. (See discussion of intestinal indigestion.)

Foreign Bodies. In many instances, especially in infants, doubt arises as to whether a missing foreign body has been swallowed or not. The most careful search should be made for it, outside of the patient, and the stools should be sifted as a routine for several weeks, unless the body is discovered. The writer's sieve enables these examinations to be made quickly and with little trouble or offense. Most foreign bodies can be discovered by the X-Rays, unless lodged in line with bony structures. On account of the movability of foreign bodies, the fluoroscope is, on the whole, better than the radiograph. It is improbable that an

infant's oesophagus will pass a body more than 9 millimeters in circumference, or an adult's oesophagus one more than 15 millimeters. Subject to delay at the pylorus, ileo-caecal valve, rectal valves and sphincter, and in loops of intestine, a body that can pass the oesophagus can usually pass the entire alimentary canal. Long slender bodies are, however, specially liable to be retained indefinitely.

In order to guard the walls of the canal, and facilitate peristalsis, a very bulky, coarse diet of cellulose-containing vegetables, bran bread and puddings, should be immediately instituted. Absorbent cotton has been advised to catch and guard the foreign body but there is some danger of obstruction. Fish bones, fragments of meat bones and metallic objects other than the noble metals, may be dissolved by hydrochloric acid in the stomach so that, unless in the case of brass and other poisonous metallic compounds, it is advisable to maintain acidity at a considerable degree. At least, sharp objects will be blunted by the corrosion.

Hair balls, common in cattle and quite frequent in horses and other quadrupeds which use the tongue to cleanse the body, are found in human beings only as the result of perverted habits or the use of the lips and teeth to assist in manipulating the hair. Thus they are practically limited to hysterical females. Short hairs of any kind rarely lodge in the human stomach. Pending operation it must be remembered that there is a ball-valve obstruction and relative microgastria, unless dilatation has occurred.

CHAPTER XXXIII.

GENERAL PERVERSIONS OF DIGESTIVE FUNCTION.

Seasickness.

To some degree, seasickness is produced or imitated by dietetic errors prior to or after sailing. Genuine seasickness seems to be a disturbance of equilibrium, partly visual but mainly due to actual motion and includes in its symptomatology and pathogeny, a condition of shock and of gastric irritability, sometimes one, sometimes the other being more prominent. The movements of the abdominal viscera, especially the heavy liver and the kidneys—particularly if already preternaturally movable—probably tug upon nerve filaments, since the condition is to some degree relieved by the horizontal posture and by bandaging the abdomen. Essentially the same condition may be caused by the movements of any other vehicle or even a swing or hammock.

Farewell banquets, alcoholic excess and various dietetic errors often produce symptoms which are called seasickness on water but which may be entirely independent of this condition. However, an abstemious diet and a mercurial purge before sailing have some value as prophylactics.

Any narcotic or sedative drug will control seasickness if given in adequate dose, subject to the qualification that mild sedatives have no positively efficient dose and that the more powerful ones are objectionable.

Two radically different methods of treatment exist; sailors advise forced feeding or drinking of sea water, alcoholic beverages etc. The opposite method is to follow the inclinations of the patient and to allow him to abstain from food unless the seasickness lasts so long as to reduce the strength too much under starvation treatment. Lemon juice, raw prunes, oranges, clear tea, iced

champagne and various other beverages are recommended to quiet the stomach. Toast, wafers, salt or smoked meats etc., usually excite less disgust than fresh meat, vegetables and desserts but, in true seasickness, the patient vomits until the stomach has squeezed out its contents, when it will usually remain passive till more food is taken.

Whether it is better to try to force the patient to eat or not, is a moot point, and the merits of the individual case must be considered. Most persons are rather benefited by a fast of a few days. The terrible depression is the main factor in seasickness and may require hot saline enemata or rectal alimentation.

Perversions of Appetite.

Anorrhexia amounting to disgust for food is conservative in many instances of acute gastric and intestinal disorders and should not be opposed. In prolonged fevers, notably typhoid, it becomes necessary to force the appetite. The term disgust requires qualification; sometimes there is genuine nausea and loathing; at other times the patient simply feels that he cannot eat but the thought or sight of food is not repulsive; again, the patient desires food but from experience, or prejudice which may amount to an insane delusion, feels that it would distress or harm him.

There are normally great differences in the appetite among different persons and in the same person at different times. Repression of the appetites in general, excessive self control and habits of abstinence, even amounting to obsessions, often lead to loss of enjoyment of food or, by resulting in contraction of the stomach, in actual inability to eat sufficiently except by careful restriction of diet to concentrated foods or by multiplication of the meals. The strength of the digestive organs as well as of the musculature generally, is reduced by prolonged insufficiency of diet, whether due to actual lack of food, poverty, preoccupation, grief and other mental states, or to faulty notions of the patient or his physician that have led to a preconceived plan of reduced nutrition.

In acute fevers and certain organic and serious functional diseases of the digestive organs, the best plan is to administer food like medicine, in definite dose, at definite intervals, without attempting to arouse the appetite though, of course avoiding disgust. If the patient cannot exercise, rest from mental cares or otherwise naturally create a sensation of hunger, as in convalescence from many diseases, surgical confinement and many neurotic states, dainty serving of food, moral suasion and an appeal to the appetite by unusual delicacies must be the strong points. If circumstances are such that the patient can have mental rest, change of scene and out-door exercise, such methods are superior to special preparation of food.

It should be remembered that diet-kitchen traditions are not always rational. Broths are often contraindicated by their excrementitious contents and they are never "nourishing" in the sense supposed but, on the contrary, exceedingly weak in nourishment. Pasty preparations, however flavored, are often too sweet and starchy for the invalid and they soon become disgusting. The dictum that the patient should never be asked what he would like to eat is also incorrect, though obviously the weak, wretched, anorrhexic patient is not in a condition to order his meals and he will usually prefer to take nothing. It is often advisable to consult his tastes and set him thinking about food. Sometimes some one article will suggest itself to him and, unless utterly irrational and harmful, it should usually be got, as the main point is to establish the appetite and habit of eating.

Hyperorrhexia or Boulimia is, in rather moderate grade, a frequent habit of comparatively healthy persons and may even be due to a wrong conception of the amount of food necessary to maintain life. There is also a popular impression that the individual standard of strength may be elevated or a reserve of vitality established by overeating, on the same general principle as financial wealth may be accumulated by getting more than one's normal share.

Diabetes, intestinal parasites (not because the worms consume any notable quantity of nourishment), states in which the stomach rapidly empties itself, various neurotic and insane states, especially

certain forms of epilepsy and general paresis, sudden transition from want to abundance, may cause boulimia of high grade. In many cases, the patient seems actually to be kept thin by the labor imposed on the digestive organs and the resulting failure of digestion and assimilation. Sometimes boulimia seems to be purely a matter of indulgence of the grosser appetites, as, for example, in a young lady, otherwise dainty and refined, who would deliberately excuse herself from the table, induce vomiting by running her finger down her throat and return to eat another square meal. This method was also practiced by the Romans during the period of luxury.

The dietetic treatment of boulimia is obvious—regulation of the amount of food without particular reference to kind, providing the standard ration is established with sufficient accuracy—unless, of course, it occurs in diabetes, lithaemic cases etc., requiring special regulation.

Polydipsia is often indicative of diabetes melitus or insipidus but may be due to local conditions causing dryness or bad taste of the mouth, to diarrhoea—which it tends to maintain—to excessive use of salt and sugar, requiring dilution, to labor, causing excessive loss of water by perspiration and, if of sudden development, it may indicate haemorrhage. In less marked form, it is due to habit, especially with regard to alcoholics and the xanthin-beverages. Excessive milk and water drinking are habits usually traceable to misconceptions of the hygienic value of nutriment or liquid. The old Jewish rule not to take milk with meat, though not literally correct, certainly should apply to the joint use of considerable quantities. Athletes sometimes produce gastric dilatation by endeavoring to strengthen themselves by the use of large quantities of milk.

A certain sort of health cranks—unfortunately including many physicians—become impressed with the value of water as an eliminant, or with the special virtues of some particular brand of mineral water or of distilled water and use it in excessive quantities with meals, interfering with proper gastric digestion, or between meals. The passage of large amounts of water free or nearly free from mineral salts, obviously interferes with osmotic processes

generally by withdrawing salts from the blood and tissues, it induces an excess of circulatory and glandular—especially renal—work, and if pure water is used, its irritant effect on the gastric mucosa must be considered. It is possible that diabetes may be thus produced.

On the other hand, many persons, especially drinkers of concentrated tea and indolent or overworked middle aged and elderly women, habitually take too little liquid and develop a positive distaste for water. It is obvious that in such cases, all processes of secretion and elimination are interfered with.

The regulation of these dietetic vices needs no discussion.

Rumination or **merycism** is a peculiar condition, ordinarily considered a neurosis, in which the individual has the power of regurgitating food from the stomach, sometimes even claiming to be able to bring up any particular article swallowed. It is described as a pleasant habit, and seems, as a rule, to do no harm. However, the mere fact that the regurgitated morsel is described as retaining the original flavor, without sourness or bitterness, indicates a deficiency of acid secretion and peptonization or else some retention in the oesophagus, demanding investigation and proper treatment, including dietetic management.

Gastric regurgitation, whether occurring as **water brash** or otherwise, and with or without **heart burn,** etc., indicates a relative disproportion between endogastric tension and the competency of the cardiac sphincter. It is frequently due to the use of too much liquid with a meal, or to hasty swallowing, so that too much air is introduced, or to fermentation in the stomach. The strength of the cardiac sphincter is largely an individual characteristic and some persons can never stoop over soon after a meal, without regurgitating from the stomach.

Vomiting is largely a conservative process, to evacuate irritating or excessive gastric contents. Thus, animals such as horses (which do vomit occasionally), and persons that do not vomit readily, are more disposed than others to serious alimentary disturbances. Vomiting as an indication of gastric disturbance or of biliary disease, intestinal obstruction, peritonitis, pelvic

disease etc., need not be considered. Hyperemesis gravidarum is discussed elsewhere.

Vomiting is often a nearly pure psychosis, due to disgust. This form is specially important from the dietetic standpoint, as the nutrition of many delicate patients depends largely upon the avoidance of unpleasant surroundings, and the preparation of food in a cleanly and dainty manner.

Hiccough, of brief duration, is usually a gastric or oesophageal reflex, more often the latter, spasmodic oesophageal peristalsis being set up by swallowing too hastily, or by swallowing too dry or too large boluses.

Prolonged singultus may be a psychosis or may be due to various reflex stimuli, as from biliary calculi, pelvic disease, etc. It is a very serious condition and an important—though not always successful—item in the treatment, is the establishment of normal oesophageal peristalsis by the use of bland food, usually of a liquid character. Theoretically such liquids should be given lukewarm but, often, extremes of temperature are of service. Chewing gum or allowing sugar or candy to melt in the mouth, and the sweet liquid to be swallowed, often gives relief in brief hiccough and sometimes in the severe grade. Various aromatic and alcoholic substances may be employed.

Aerophagia must be distinguished from eructation of gas due to the literal swallowing of air with food and drink, to the formation of gas by effervescence or fermentation, or by the action of gastric acid upon intestinal carbonates, with the pylorus relaxed. Genuine aerophagia is an exaggerated hiccough, with drawing of air into the oesophagus—probably rarely or never into the stomach—and its alternate expulsion. The term is not, therefore, literally correct. It is practically always a pure neurosis and manifestation of hysteria, and while it may be associated with gas in the stomach and may be excited by the causes of hiccough and somewhat relieved by the same treatment, it is amenable rather to moral suasion than dietetic treatment.

CHAPTER XXXIV.

FUNCTIONAL INTESTINAL DISEASES.

Diarrhoea and Constipation.

The movements of the bowels are dependent upon peristalsis in the absence of obstruction and upon the presence of a suitable solid, gaseous and liquid mass within. Constipation is usually due to sluggish peristalsis while the term obstipation is limited to obstruction of greater or less degree. Diarrhoea is usually due to heightened peristalsis secondary to irritative or actually inflammatory conditions of the intestine itself. Increase of liquid, whether by increased ingestion, disproportion between secretion and absorption or exudation, especially the last, is an important factor. Brief or intermittent diarrhoea is also often due to gaseous tension. While a large quantity of solids in the bowel conduces to effective peristalsis, a small quantity of especially irritative solids may cause diarrhoea while astringent solids or those that are neutral in chemic action but which tend to form large masses, may cause obstruction. Thus, berry seeds may act sometimes as laxatives, sometimes in the opposite way, in the same or in different individuals.

A general rule, often ignored, but highly important, is not to combat either diarrhoea or constipation by setting up the opposite condition nor even by the use of agents which, without passing to the opposite extreme, still tend to produce the opposite pathologic condition.

The liberal use of water tends to produce freer movements of the bowels, not so much by directly increasing the water in the contents as by affording freer secretion, by lessening the need of marked absorption of water and by promoting vital processes generally. Large quantities of distilled water are apt to be irritat-

ing. Watery fruits, vegetables, soups and beverages, obviously act similarly to water as such but are more or less open to objection, by introducing fermentative material, toxic waste, xanthin derivatives, tannin etc., according to their individual nature. Water strongly impregnated with minerals may be irritating or astringent. Water taken very hot in small divided portions, especially if salted or containing fruit juice, sugar etc., to facilitate osmosis, is rapidly absorbed and is cholagogue and diuretic, rather than laxative. The most effective method of use of water as a laxative, is to take a glassful, cold, some time before breakfast.

Almost any substance soluble in water, acts as a cathartic if given in greater concentration than that of the blood serum, by drawing water into the bowel and, probably, in most instances, by reflex irritation also. The use of salines and glycerin for this purpose is rather medicinal than dietetic. Sugar, in various forms, is laxative, but it should not be used in so great an amount as to cause glycosuria, obvious gastro-enteric irritation, nor fermentation. 100 grams at once or 200 in one day, should be considered the limit.

Saccharine fruits combine the effects of water, salts and sugar and also contain moderate quantities of cellulose. There is considerable variability in their laxative effects. Given a not too marked coprostasis with fermentation and some exudation behind it, the increase of fermentation and peristalsis produced by fruit, is very apt to cause an explosive diarrhoea. Indeed, even the progress of a meal through the stomach and upper intestine, may compress the gass ahead so as to result in catharsis, somewhat after the principle of the quill potato-shooter, although, even in the most extreme cases, there is never an uninterrupted column of air in the bowel, under high pressure. Considerable idiosyncratic factors exist with regard to the laxative effects of fruit. A single sour apple for some persons, sweet apple for others, dish of stewed prunes for still others, may act very promptly and efficiently, while others will have no appreciable effect from what appears to be excessive indulgence.

The paradox that solids pass through the bowel more quickly than liquids, is explained by the presence of the valvulae conni-

ventes. Any solid not so large as to block the alimentary canal, at least at the sphincters, and which is smooth and large enough to ride upon the crests of the valvular waves, will usually be evacuated in the first passage occurring after a period of four or five hours after ingestion, while the softer parts will be evacuated, mostly in the passage of the next day and somewhat in the passage of the second day afterward.

Large smooth seeds, berries, corn, peas, beans, and lumps of beet, radish etc., imperfectly masticated and not sufficiently softened by cooking for thorough disintegration during starch digestion, will, if no excess of fermentation or mechanic irritation occurs, pass through the bowel more rapidly than the properly prepared food mass with which they were introduced, except that they may be retained in the lower bowel. Thus, residue of this sort, under the conditions named, does not act as a laxative. If the conditions are not fulfilled, such residue may, on the one hand, produce an irritative diarrhoea, on the other a coprostasis. Such masses, due to the neglect of proper comminution of food, may, of course, often substitute a mild diarrhoea for a state of constipation, but should not be used with this end in view.

Caraway seeds, seeds of raspberries and blackberries, scales of apple and pear cores, oat husks etc., are very often found in the stool sieve—a very instructive, simple, cleanly, and much neglected instrument—a week or two after ingestion and, in elderly persons of sedentary habit, not infrequently several weeks after the time of their ingestion. Sometimes there is obvious fermentation and mucous catarrh in the pockets of the colon in which these substances lodge, sometimes they form an obstruction quite analogous to a dam of pebbles in a stream, sometimes diarrhoea results from the irritation at the sites of retention or, if this site is the caecum or appendix, very serious inflammatory lesion may result, with septic consequences. As a rule, if the intestinal mass is otherwise sufficiently bulky and soft, such small particles are imbedded in it and swept through without doing harm. Yet, obviously, their action is too uncertain to be depended on therapeutically.

Masses of unchewed meat, gristle, tendon ends, fragments of bones etc., act analogously to the first group of vegetable masses considered.

In short, the only kind of indigestible residue which can be relied upon to produce a laxative effect, without more or less danger, is the soft, moss-like network of cellulose found in green vegetables, fresh or dried fruits, bulbs, tubers, soft roots and stalks etc. Even figs are objectionable on account of the small seeds.

It is much better to administer a medicinal cathartic than to employ dietetic measures that produce marked gaseous fermentation, that result in a large mass of residue containing undigested starch or that eventuate in a colliquative diarrhoea as practically always follows the excessive use of relatively innutritious vegetables.

Any kind of oil or fat when used in excess of the physiologic limit—about 150 grams a day—is laxative, even if no excess of fermentation occurs. Clear fat or oil, taken without other food, is more laxative than that properly mixed.

It is usually overlooked—indeed the observation may be claimed to be original, at least in its practical application—that normal movements of the bowels depend to some degree upon the production of carbon dioxid gas by the reaction of gastric hydrochloric acid with pancreatic, biliary and intestinal alkaline carbonates. It is a conservative estimate that, in the digestion of the three meals, at least one gram of pure hydrochloric acid is secreted by the stomach and more than enough alkali for its neutralization. From the molecular weights, it is a matter of simple calculation that each gram of hydrochloric acid yields 44/73 of a gram of carbon dioxid, occupying at body temperature and ordinary atmospheric pressure a volume of 1200 c.c. Thus, the maintenance of a digestive equilibrium between the acid and alkaline factors, is important in securing normal intestinal movements.

Any food may be considered constipating which contains tannic acid or which yields little indigestible residue. Thus, even liquid foods such as milk, provdiing that the quantity of water is not too great, that digestion is good and germ activity not

excessive, and that balancing cathartic factors, including idisyncratic irritation are not present, are constipating. Tea is especially liable to produce constipation, not only because it contains considerable tannin to act upon the bowel, but because it is commonly used by those who take too little water and too little food, and also because it tends to depress gastric secretion so that the normal formation of carbon dioxid from the interaction of hydrochloric acid and alkaline carbonates, is diminished. Obviously, any great formation of organic acids by fermentation would result in carbon dioxid production and even irritative diarrhoea might result.

Milk curds which do not digest, may act to produce diarrhoea almost exactly like lumps of unchewed meat.

Very fine wheat or rice biscuits, especially if made with considerable raw flour may result in faecal accumulation.

Bread stuffs made of fine cereal flours, cooked milk, eggs, beef juice, etc., barring indigestion and fermentation, yield little residue, and are, therefore, constipating.

On an average diet, fully half of the faecal mass consists of bacteria, shed epithelium and true excrementitious matter, largely discharged in the bile. Thus, even on a diet as free as possible from indigestible residue, the faeces amount to 30—50 grams a day.

Intestinal Indigestion. Owing to the fact that intestinal digestion takes place in a long cavity, whose contents are not retained in any one place for a fairly regular physiologic period of considerable length, it is impossible, even by physiologic experiment, to make as definite statements regarding its course, as for that of gastric digestion. Owing, also, to the practical impossibility of withdrawing contents for examination from above, and to the fact that the faecal discharge always consists of overlapping ingredients, that digestion and absorption are normally nearly completed in the caecum, some hours before the faeces are finally obtainable and that digestive processes are confused by high grades of chemic change due to bacteria, it is impossible to study clinically, the process or results of intestinal digestion, with any degree of accuracy comparable to that of gastric digestion.

Hence, while it is very easy to use the term intestinal indigestion, it is very difficult to do so in an intelligent manner. That

is to say, we cannot discriminate sharply between apparently functional and plainly organic disturbances of the intestine, nor can we discriminate indigestion from saprophytosis even to the approximate degree possible for stomach contents. Again, it must be remembered that true failure of digestion *in* the intestine is not so much a disturbance *of* the intestine as of the pancreas.

Thus, the intelligent dietetic treatment of so-called intestinal indigestion, must depend upon an examination of the faeces, a consideration of the perfection of mouth and gastric digestion, the indirect evidences of pancreatic and hepatic lesions, and the inspection of the rectum, if blood, mucus, pus etc. appear.

The intestine cannot be expected to digest dense masses of either vegetable or animal tissue. Hence, the appearance of undigested huckleberries, corn, peas, beans, tendon ends, pork rind etc., does not constitute a true intestinal indigestion but demands proper comminution, outside the body, or by mastication, or more careful trimming of food. Small macroscopic or microscopic masses of cellulose, plant hairs, and the yellow masses of altered muscle, are to be expected in any case. An excessive indigestion of relatively indigestible and innutritious vegetables naturally leads to increased peristalsis, watery discharges and considerable fermentation of cellulose. While literally an intestinal indigestion, such an occurrence, with relatively enormous waste of ingested nutriment is inevitable and the only appropriate radical treatment is to remove the dietetic cause.

In other cases, the so-called intestinal indigestion consists in a marked increase of saprophytosis, sometimes mainly involving the proteids by the increase in colon bacilli, in numbers or virulence, when indicanuria and sulphur-containing gases enable a clinical diagnosis to be made; sometimes mainly the carbohydrates, including cellulose. In some cases the bacillus lactis aerogenes is the principal offender. Again the saprophytosis consists in an enormous development of yeast cells, so that the faecal mass, if kept warm, rises almost like a mass of dough or froths if more liquid. Herter has demonstrated the frequent occurance of the bacillus acrogenes capsulatus.

In such cases, there is a general indication to purge the in-

testine, to administer small quantities of almost perfectly digestible foods, with artificial digestion or digestants, if necessary. In order to lessen the development of a particular kind of microorganism, the pabulum should be changed, that is to say, an entirely different kind of diet should be instituted for a longer or shorter period. If the condition has been mainly one of putrefaction, meats should be discontinued and cereals and fresh vegetables should be given. Especially in infants and fever patients, there is often an indication to discontinue milk and use white of egg and meat extracts, with cereals if not contraindicated.

Many cases of so-called chronic intestinal indigestion are really cases of colitis, with mucus varying in consistency from a gelatinous mass to dense shreds, usually believed to be "casts," especially if tubular. The inflammation of the large intestine may be quite local, as a proctitis, typhlitis or appendicitis.

True intestinal indigestion can be determined only by careful chemic tests either of the faeces directly or by means of Einhorn's method of attaching different kinds of food as mutton fat, tendon or catgut, muscle, raw and cooked potato, to beads of different colors, using gauze if necessary to prevent accidental detachment of friable substances.

For obvious physiologic reasons, a true intestinal indigestion usually indicates pancreatic failure. Much confusion has arisen from the search of medical Ponce de Leons after pathognomonic signs. It should be realized that an organic lesion of the pancreas, especially if localized, does not necessarily interfere to a conspicuous or even to an appreciable degree with function, and that repair and compensatory hypertrophy or superfunction may occur, just as for any other organ. It is precisely as irrational to expect macroscopic evidence of fat indigestion or absolute failure to digest raw starch in a pancreatic lesion, as to expect the average case of hepatic sclerosis to manifest glycosuria or the average case of pneumonia or pulmonary tuberculosis to manifest dyspnoea, of extreme degree. On the other hand, a functional failure may occur when the pancreas is not organically diseased.

Thus the dietetic management must correspond to the actual findings and not to what might be expected a priori.

CHAPTER XXXV.

ORGANIC INTESTINAL DISEASES.

Asiatic Cholera is believed to be the purest type of an infection whose germs are borne by drinking water and hence, also by accidental contamination of food. In respect to mode of conveyance, it is commonly associated only with typhoid but it is probable that dysentery of both amoebic and bacillar types should be placed in the same category. On the other hand, it is not unlikely that, with greater opportunity for study, cholera will prove to be conveyed to a considerable degree by flies, dust and direct contact.

Prophylaxis includes personal cleanliness, especially with regard to the hands when eating after contact with patients or fomites but, especially, the avoidance of all raw food and unboiled drink, during an epidemic. The water used for washing dishes and food and even that used for personal cleanliness, should have been boiled.

As the cholera spirilla (comma bacilli) are unfavorably influenced by acid media, lemonade, especially reinforced with hydrochloric, sulphuric or phosphoric acid, lime juice, vinegar, sour pickles etc., may be used quite freely but not in sufficient quantities or at improper times, so as to disturb digestion. All forms of indigestion should be avoided, gastric subacidity especially should be treated with dilute hydrochloric or phosphoric acid and rich, indigestible food should be avoided. It is often taught that anything liable to cause diarrhoea favors the development of cholera but it is doubtful whether there is any special tendency in this direction.

During the first period of premonitory diarrhoea, it is probably best to abstain altogether from nourishment, though acid drinks, especially aromatic sulphuric acid, are indicated. If there seems to be special indication to nourish, light broths, meat extracts,

gruels, whey with hydrochloric acid, buttermilk and milk partially predigested by adding hydrochloric acid rather than by pancreatic alkaline predigestion, should be used.

In the second stage of serous diarrhoea, nourishment by either the mouth or rectum is out of the question. Cracked ice, lime water, champagne, Vichy and other carbonated waters may be given, also clear coffee or tea as a stimulant, and the acid drinks may be continued. Inunction and hypodermic nutrition may be employed.

In the third or algid stage, hot saline enemata may be employed, if they can be retained even for a few minutes, but hypodermoclysis and, theoretically, the author's method of adding dextrose to the salt solution, is the mainstay.

In the reactionary stage, rectal alimentation may be used if the bowel is retentive and feeding by mouth may be gradually resumed, at first using teaspoonful doses of peptonized milk, beef juice, koumiss, with or without alcoholics, as thought best. The diet appropriate for typhoid may be instituted after a week or so, then that suitable for convalescence from typhoid, but the return to full diet should be very gradual, often covering a period of a month or more.

Cholera Nostras.—There is considerable bacteriologic evidence especially in the line of agglutination experiments, to indicate that cholera nostras, particularly affecting infants (Cholera Infantum is not strictly a distinct disease), is due to the infection of the small intestine rather than the large, with dysentery bacilli, at least of one strain. On the other hand, the identification of bacteria by morphologic and chemic tests, even by agglutination, is liable to fallacies, and it seems inexplicable that specific dysenteric infection should occur so commonly in this clinical type without the occurrence, at least with considerable frequency, of typic dysentery. At any rate, cholera nostras, including cholera infantum, whether specific or not, is due to increased germ life in the intestine.

Hence the prophylaxis includes the avoidance of tainted foods, the boiling of water, pasteurization or sterilization of milk

and the limitation of the diet to the standard ration of easily digested foods, thoroughly sterilized by recent cooking, excepting for the use of such fresh fruits and vegetables, in moderate quantities, as are least likely to be sources of infection. The disturbance of digestion by irregular use of soft drinks, and especially the use of ice cream, milk shakes etc., should be avoided, and even ice water may inhibit digestion, allow saprophytosis to gain the ascendancy and start a diarrhoea.

In the case of infants, breast feeding, under aseptic precautions, as previously discussed, is the best prophylactic of cholera infantum and weaning should be anticipated or delayed so as to avoid a change to cow's milk during the hot months. The great majority of cases of cholera infantum occur in artificially reared infants and especially those of the slums, in which gross dietetic errors, milk originally tainted or in which delay and lack of refrigeration, have allowed bacteria to multiply, and the use of improperly sterilized bottles and long feeding tubes, favor alimentary saprophytosis.

In every case of cholera nostràs developing in a previously vigorous individual, with due allowance for extremes of age, the plain indication is to stop feeding and to purge the bowels, usually with divided doses of calomel followed by a saline. In infants, castor oil is often preferable, and many physicians prefer it also for adults. Lavage of the lower bowel also expedites the process of disinfection which, of course, is never absolute from the bacteriologic standpoint.

It is difficult to draw the line between ordinary transient diarrhoea with intestinal saprophytosis and a true cholera nostras or enteritis. So, too, from the anatomic standpoint, unless opportunities for direct investigation are afforded, as, fortunately, they rarely are except in young children, it is difficult to use the terms gastritis, gastro-enteritis and entero-colitis, with positiveness.

With these qualifications, it may be said that a previously healthy adult, with a mild attack of cholera nostras, may require no dietetic change except the abstinence from a few meals, although he should avoid rich and indigestible foods upon recommencing to eat.

Old and feeble persons and infants can not usually abstain from food as long as is theoretically indicated and sometimes can, at most, lengthen the usual periods between meals. In such cases, the rule is to make a considerable change in diet, to administer food as perfectly digestible and as nearly sterile as possible. Peptonized milk, boiled milk, toast water, artificial cereal-milk mixtures, sometimes buttermilk, koumiss etc., are employed. Boston crackers, toasted and moistened with tea, dry toast with salt instead of butter, zwieback—which has no obvious advantages over any other slowly and slightly toasted bread that has been kept for a few weeks—or other soft but not doughy cereal food is to be preferred to milk when milk has already been used to any great extent by adults. Sugar, fat, meat and coarse residue are the principal ingredients of diet to be avoided. Clear tea may be used rather freely provided the patient is not already too much under its influence, its value being as a heart tonic, astringent and appetizer.

Breast-fed infants may become infected through water, fruit, filthy breasts and articles handled and carried to the mouth. The autochthonous germs of the alimentary canal may also develop a special virulence if digestion is disturbed by frequent, irregular nursing. If possible, several nursings should be omitted, the child being given boiled water with a little salt, at the regular feeding times. If the child is very feeble, it requires considerable courage to discontinue its nourishment, or even to change from the accustomed, normal food, although it is a question whether this would not be the best routine treatment. At any rate, the intervals between nursings can be lengthened to four or six hours and relative asepsis of the maternal breast and the child's mouth can be secured.

Unfortunately the decision for or against substitute feeding or suspension of nutrition, has to be made promptly and without waiting for the result of experience. If there is any probability of deleterious change in the maternal milk, as on account of fever, notable digestive disturbance, Bright's disease, or emotional shock, nursing should be discontinued.

Peptonized, sterilized cow's milk, prepared according to the

usual formulas, excepting that cream should usually be omitted, may suffice as a change of diet, but it is probable that the heightened virulence of intestinal bacteria will be equally well maintained by milk of a different species. We are further hampered in the treatment of infants by their inability to take starch and cereals generally. The non-starchy proprietary infant's foods sometimes act very satisfactorily in cholera infantum. White of egg with a little salt, in water, is often well borne and it may be supplemented with milk sugar. During the first week, the child normally takes about 300 c.c. of milk a day while, at the close of the first year, fully four times as much is taken. While the milk varies considerably in composition in different women and while the first milk secreted is not up to the full standard, Leeds has shown by a large series of analyses that there is no great progressive change in composition and the average is about 4% of fats, 7 of lactose and 2 of proteid. Thus one white of egg and 21 grams of lactose would represent nearly the full ration, except fat for the first week. Another white of egg would almost exactly supply the calories normally derived from fats. At the close of lactation 4 whites of eggs and 80 grams of lactose would represent nearly the entire ration except fat, and four more whites of eggs or 2 more whites of eggs and 10 additional grams of lactose would nearly compensate for the lacking fat.

Expressed beef juice, gelatin etc., may also be employed. If the saprophytosis is mainly of a putrefactive kind, as it usually is, buttermilk may be employed. Sometimes, as in more chronic intestinal disturbances, the substitution of goat's milk for cow's milk, works well. Fresh cocoanut milk is theoretically available.

Both in adults and in infants, alcoholic beverages, mainly the best brandy, or champagne if there is great gastric irritability, is of advantage, subject to the general limitations to the use of such beverages. For infants, a drop or two of brandy is sufficient and even this dose, if frequently repeated, will cause intoxication which may be confused with febrile symptoms.

Dysentery is a term often loosely used to designate any form or grade of colitis. It is generally conceded that it should be limited to colitis of specific, infectious etiology but some confusion

remains since both the amoeba coli and Shiga's bacillus have been found in cases considered clinically specific. Moreover, at least two varieties of the bacillus have been described and one of these is now considered by many as the cause of ordinary cholera nostras, including cholera infantum. Then, too, it is claimed that one form of amoeba is merely an intestinal commensal parasite, not pathogenic unless by causing a mild grade of irritation, while another form is strictly pathogenic.

In the eastern tropics, Shiga's bacillus is generally found in acute cases of dysentery, while amoebae are more frequently found in chronic cases and even in persons in good or fair health. Obviously, therefore, both germs may be found in the same case. Whether the American dysentery is identical with either form, is not fully established. Thus, it is impossible to speak with certainty as to the etiologic relations of food and drink to the development of the disease, although the wisdom of applying the same general principles of prophylaxis as for typhoid fever and cholera, is apparent.

As, in dysentery, the infectious lesion is mainly limited to the large intestine, it is usually possible to nourish throughout the disease. Owing to the lesion of the colon, it is advisable to use food with as little indigestible residue as possible. In most cases, peptonized milk and egg, boiled milk, beef juice, whey, milk and lime water, with or without whisky or other alcoholic, should be used. Raw scraped beef is highly praised by some, though it would seem better to insure some degree of sterilization by toasting it on a hot plate.

Hot salt solution may be given by enema or hypodermoclysis, perhaps with dextrose added to the salt solution, may be employed.

During convalescence, the diet should be carefully regulated and a middle course should be steered between a vegetable diet which yields irritating residue and one too closely confined to meat, eggs and milk, which favors intestinal saprophytosis and thus, indirectly, hepatic abscess. Even when amoebae are found in the bowel and in the hepatic abscess, they probably cause the latter only by carrying colon bacilli and other more or less distinctly pyogenic bacteria. Eggs, custards, gelatin preparations,

rice and other fine cereals, blanc mange, arrowroot, tapioca, and such meats as steak, roast beef, broiled lamb chop, fresh fish may be used. Moderate quantities of lemon, orange, lime and pineapple juice should be given, but not fruit itself nor any notable quantity of butter, cream, or any other fatty food.

Amoebic dysentery of the more chronic, wasting grade, is attended with marked anaemia, and requires iron in some form, hence, meat, blood if it is well borne, or bovinine, should be given. Otherwise, the diet should be easily digested and nourishing and should be about as for early convalescence from typhoid and other fevers in which the intestine is involved. Predigestion will be required in the majority of cases and the concomitant administration of the vegetable ferments, not only to digest the food but to aid in removal of stringy mucus and possibly, to exert an unfavorable influence on the parasites, is indicated. Inunction and hypodermatic nutrition may be employed.

Acute Colitis of temperate climates is ordinarily regarded as an infection with the colon bacillus or with various bacteria, not specific, more or less permanently denizens of the intestine. It is thus due, both directly and indirectly through irritation of the intestine, to putrefying food and indirectly to various causes of intestinal indigestion. According to one view, it differs from cholera nostras, only in the part of the bowel affected, and is due, like cholera nostras, to one strain of true dysentry bacillus.

The dietetic treatment is similar to that of tropical dysentery but, on account of the generally less severe grade of the disease, there is less urgency as to nutrition and greater indication for cathartic treatment at the beginning and abstinence from food for several days. The diet then instituted should be about as for convalescence from typhoid.

Chronic Colitis may develop on account of portal obstruction, or without these elements, it may occur as the result of repeated saprophytosis due to a diet rich in putrescible proteids, to the continued use of tainted meats etc., while constipation is both an effect and a cause. The colon may become dilated, and paralytic. In some way, coffee used to excess, seems to be a cause. Chronic colitis may also follow the acute forms, including the various forms

of dysentery and may be distinctly of toxic origin, as from lead, arsenic etc. The constipation of chronic colitis is apt to be interrupted by periodic diarrhoea, when considerable mucus is discharged, either as slimy masses, as strings or as casts, which are rarely true exfoliations of epithelium. Some consider mucus colitis to be a neurosis but it should be remembered that nowhere else is the discharge of mucus regarded as analogous to a neurotic supersecretion, that the analogy drawn to true secreting glands is not well taken and that the general neurotic symptoms are readily explained as the result of the organic process, there being no good evidence that the so-called neurosis antedates the lesion.

It is usually taught that the dietetic management of such cases demands the avoidance of vegetables with indigestible cellulose and the use of foods as perfectly as possible, digestible in the stomach and small intestine. Such a diet has just been described for convalescence from dysenteries and acute colitis.

Recently it has been advocated to administer foods rich in indigestible material, as coarse meals, cracked corn, etc., with the idea of mechanically removing mucus and stimulating local blood supply.

The proper course seems to be midway between these extremes. There seems to be no question that corn, apple scales, grape seeds etc., may increase the inflammation mechanically. On the other hand, the finer, chaffy residue of whole wheat, and the soft cellular net work of green vegetables can not produce mechanic injury but may serve a useful purpose in gently sweeping mucus from the bowel wall. Again, foods rich in proteid and especially meat and eggs and even milk curds, are prone to putrefy and serve as a pabulum for the colon bacillus and allied germs. On the other hand, the fermentation of cellulose favors the development of antagonistic bacteria and, if not carried to an extreme may thus do good. Fats and oils are commonly described as healing to the bowel but it should be remembered that the substances produced from them both by digestion and by bacterial action, are irritating.

Thus, the most appropriate diet is nearly vegetarian, with moderate quantities of milk, eggs and small quantities of meat, which should be absolutely untainted. There seems to be no objection to the occasional use of tender boiled ham, dried salt cod fish and even other preserved meats. The vegetable foods should include the cereals and bread stuffs, with avoidance of hot biscuits, pie crust etc., and soft, well divided fresh vegetables, especially in the form of purees. Even cauliflower, lettuce, creamed asparagus, peas and green and lima beans may be allowed. If starch digestion by the pancreas is good, bananas may be used. Fresh and stewed fruits, excepting those containing seeds, as raspberries and blackberries, may be used. Grapes should be seeded before swallowing. Sugar should be allowed in small quantities only. Butter and cream should be allowed in reasonable quantities but an excess of fats—say over 50 grams—should not be given. If necessary, fats may be administered by inunction. The olive oil treatment should not be followed but it may be allowed to mention the advantage of purpetrol, which is not changed by digestive or bacterial processes and which maintains its oily, soothing character throughout the intestinal canal. Owing to their possible constipating action, tea and coffee should be allowed in very small quantities and alcoholics should be given only as indicated to stimulate gastric digestion.

The insurance of proper gastric digestion is important.

When there is a tendency to colonic dilatation, the utmost care should be taken to avoid retention of contents. On the other hand, frequent purgation does harm and the attempt to avoid retention by administering foods with very little residue defeats the object in view. By gentle massage, encouragement of regular habits of evacuating the bowels, the administration of an abundance but not an excess of water, the use, regularly, of vegetables and fruits containing soft cellulose but not dense seeds, and of purpetrol as a lubricant, a mean may usually be struck between accumulation of residue and constipation due to insufficient intestinal contents.

Chronic Intestinal Ulceration may be directly due to colitis or to syphilitic, tuberculous or other specific processes, the latter

group of cases more or less theoretically demanding operation. The diagnosis is not easy and such cases will, for practical dietetic purposes, usually be considered either as chronic colitis or as intestinal obstruction.

Duodenal Ulcers are usually closely analagous to peptic gastric ulcer, with difficulty diagnosed from the latter and requiring the same dietetic management.

Colitis may be more or less limited to certain parts of the bowel. Proctitis and rectal and anal lesions generally, require no special dietetic regimen, excepting to avoid hard, irritating particles, such as seeds, cores etc., and the formation of scybalous masses in the colon by too concentrated and too dry diet. Though not strictly a dietetic point, the importance of avoiding accumulation of faeces on account of the dread of the pain of passage, may be emphasized. Tape-like and macaroni-like faeces may be due to reflex spasm low down in the bowel, or to the pressure of the uterus or of some pelvic mass on the rectum, and not to a true intestinal obstruction.

Typhlitis is a frequent localization of colitis, undoubtedly due to the fact that the caecum and ascending colon act as a standpipe so that delay of intestinal contents and bacterial changes, are especially prone to occur in this region. Surgeons commonly ridicule the standpipe theory, forgetting that they usually see the patients after the standpipe has been in a horizontal position for a day or two and after efforts have been made to evacuate it.

Appendicitis, in the general sense, may include various specific inflammations due to tuberculosis, typhoid etc., or local manifestations of cancer and other pathologic processes and may theoretically occur primarily, from lesion from without, within and originating in the interstitial tissue. It may also occur from traumatism of strictly foreign bodies, as sharp seeds, bristles accidentally swallowed from tooth brushes, shot from game, bits of solder from canned goods, fragments of bone etc. More or less anomalous states in regard to the adequacy of the blood supply, length, size of the lumen, direction, situation favoring entrance of material from the small intestine, adequacy of musculature and restriction of efforts to clear itself of entering material by anatomic

position with relation to pertoneal bands etc., also determine the vulnerability of the appendix.

The great majority of cases of appendicitis, however, are due to localizations of the essential features of colitis and, in particular, of typhlitis, and the special importance and gravity of appendicitis is due to the small lumen and embryonic condition of the appendix, as compared with the caecum generally and the fact that it is more prone to perforation than the intestine generally, the gall bladder or even the Fallopian tubes. It should, indeed, be remembered that the appendix vermiformis is not an appendix in the strict sense but that, owing to the evolution of man and the change in his habits of eating, especially in the restriction of coarse, bulky foods and the use of fire in preparing foods, it has become unnecessary for him to have a long caecal pouch, so that this part of it does not expand beyond the calibre of the early embryo.

Thus, with the exceptions noted, which are really entirely distinct lesions, appendicitis is essentially a form of intestinal saprophytosis, mainly involving increased virulence of the colon bacillus, and resulting in a localized catarrh and sepsis—not, indeed, usually limited to the appendix itself but extending over part of the caecum or even over the whole caecum and sometimes over nearly the entire large intestine. If it were not for the small calibre, preventing ready egress of putrescent contents, for the inflammable lymphoid tissue and poor blood supply and perhaps strictly neurotrophic factors, there would be no special tendency to burrowing inflammation and, were it not for the imperfect protection against perforation, even the invasion of the submucous and muscular coats, would not be particularly dangerous.

Thus, excepting for the inevitable and virtually anomalous predisposing factors, appendicitis is largely due to dietetic causes, as is intestinal saprophytosis and inflammation in general. Among these causes, the use of an excess of proteids and especially of meats, the use of tainted foods, neglected intestinal indigestion, and stagnation of contents—constipation—are the chief ones. The swallowing of foreign bodies, including seeds, scales, bones etc., is only occasionally a cause of appendicitis. It may be noted in

passing that the term appendicitis is utterly indefensible and that scolecitis or some similar word should be substituted.

The diet in acute appendicitis should be nil, not only to reduce bacterial activity, the empty intestine becoming nearly sterile in a day or two, but for the very practical reason that it may be necessary to give an anaesthetic on comparatively short notice. Water, however may be given quite freely. Inunctions and hypodermatic injections of dextrose, salt and water, may be employed if the patient is much reduced but, as a rule, these are unnecessary.

Within two or three days, one of three conditions exists: the patient has either been operated upon, when the dietetic management should be as after intestinal operations generally; or sepsis or gangrene or both have developed when the diet will depend upon the decision for or against operation under unfavorable circumstances; or the patient will be practically out of danger though not necessarily on the way to permanent cure.

It will be noted that the diet appropriate to septic fevers must be somewhat modified when the integrity of the bowel is impaired. Indeed, if perforation is probable, feeding by mouth and even by rectum is contraindicated. Clear coffee may be given by the mouth and inunction—not in the abdomen—and hypodermoclysis with dextrose added, may be employed but time should not be wasted in "building up the patient's strength."

When the evidence is in favor of resolution, milk and cereal diet may be begun after the third day, unless the course is unusually slow. The cereal should be of a fine and soft nature, free from chaff and gritty particles.

After about a week, all cases of appendicitis may be placed on approximately the same diet, with obvious modifications according to individual requirements and peculiarities, especially in the way of complicating diseases, such as the various forms of indigestion, obesity—which is mechanically serious in all persons liable to require deep operations—hepatic sclerosis, renal degeneration etc.

Three principles should be observed: Avoid the use of foods favoring intestinal sepsis; avoid mechanically irritating food resi-

due and especially small particles which may enter the disabled appendix; keep the bowels moving freely but not in a state of diarrhoea.

The first of these principles requires that the patient should be nearly a vegetarian. Tainted meat and such meats as are digested with difficulty are especially to be avoided. Not over 100 grams of meat should be allowed daily. Even eggs and milk should be used in moderation, milk being especially liable to colon bacillus infection. As a rule of thumb it may be said that not over 20 grams of egg and milk proteid should be allowed nor over 30 grams from animal foods generally. Remembering that 100 grams of meat contains about 20 grams of proteid, 100 c.c. of milk about 4 grams, and each egg about 8.5 grams, the proper allotment can be made.

The second principle necessarily restricts the vegetable diet and must be remembered in applying the third. Oatmeal and all chaffy and gritty cereals must be excluded, as well as tough skins, cores, and fine seeds. Raspberries, blackberries, currants and grapes must not be taken in their natural state. Figs must not be used as laxatives although prunes and dates, as well as most succulent fruits may be. While much nonsense has been taught regarding the frequency of the origin of appendicitis from seeds, the possible danger from such bodies after susceptibility has been established and after inflammatory processes of the appendix itself and adhesions around it prevent its ready discharge of matter entering it, is a real factor. The coarse, nearly innutritious vegetables, if finely cut or chewed, favor peristalsis and their cellulose is not a traumatic factor but not enough should be used to produce diarrhoea nor marked intestinal fermentation. Dry beans and peanuts seem to be especially frequent exciting causes of appendicitis though green beans, lima beans and peanut butter do not.

Irregular meals, especially at night, are frequently exciting causes of appendicitis, possibly because at such times, cheese, lobster, crabs etc., are eaten more than at regular meals.

Moderate but not excessive use of sugar and fats should be allowed.

Water should be used freely but not beyond the physiologic standard and the xanthin beverages should be allowed only in small amount.

Exacerbations of appendicitis sometimes occur so promptly after rectal injections as to suggest something more than a coincidence, thus they should be used cautiously to secure movements of the bowels and rarely if ever as a means of nutrition.

Acute Peritonitis is now recognized as mainly a secondary, septic condition, requiring surgical intervention. Especially when the lesion is in the wall of the alimentary canal, or when there is mechanic obstruction of the canal, projectile vomiting usually occurs and may even be regarded as conservative, in preventing attempts at introduction of food and in more or less completely emptying the contents already present. While, if the lesion involves the internal genitalia or, otherwise, leaves the alimentary canal free from danger of perforation or obstruction, there is no direct contraindication to careful feeding, there are obvious indirect contraindications to feeding by either mouth or rectum, during what should always be considered as the preoperative stage. Other emergency methods of nutrition may be practiced if necessary, though not usually required in the average case. After operation, the general principles of postoperative feeding should be carried out. If operation proves to be unnecessary, the resumption of feeding should usually be gradual, and on the lines already discussed for appendicitis excepting, of course, that if the peritonitis has no connexion with lesions of the alimentary canal the diet after the first week or so requires no special modification.

In hopeless cases, vomiting and gastric and intestinal distress usually add to the sufferings of the patient, if feeding is attempted and, indeed, it is usually better to administer even water hypodermatically or, if there is no contraindication, by enema. Even if the case merely appears hopeless, it is doubtful if recovery is assisted by attempts at feeding.

Without regard to the question of operation in cases of peritonitis due to pneumococcic and other diffuse infections, including chronic forms due to tuberculosis etc., the diet is not especially limited by the peritonitis itself, although it should obviously be

of a very simple and bland nature, in acute cases as in fevers in general; in chronic cases, as appropriate for tuberculosis and other wasting diseases. Considerable difference of opinion exists as to whether the intestinal movements should be allowed to progress as usual or whether by starvation or the use of foods leaving as little residue as possible, and the use of opium, peristaltic movements should be restricted.

Intestinal Obstruction. It should be clearly recognized that the chief and, indeed the only acute danger, is strangulation of the intestinal wall, mere coprostasis being compatible with life for days, weeks or, in a few extreme cases, months. Thus, we should distinguish sharply between mechanically acute cases or those in which distension with contents may produce an acute strangulation, and those in which the obstruction to the lumen of the bowel is practically the sole condition.

In the former class of cases, dietetic management must have in mind potential or actual septic or gangrenous lesion, with im minent perforation, and the obvious preparation for surgical intervention. With rather rare exceptions, therefore, all food should be withdrawn, and water should be freely used to assist vomiting or by lavage. Of course, water should not be given for several hours before operation and, often, as in intussusception, there is a period of justifiable delay but in which everything should be in readiness for operation. Hypodermoclysis may be indicated.

The latter class of cases is obviously predisposed to by ulceration, cicatrization and various partial mechanic strictures due to external pressure. A haemorrhoid or any painful rectal or anal lesion may also lead to voluntary constipation which gradually leads to obstipation, atonicity and dilatation of the large intestine and, ultimately, absolute coprostasis. Old age, and less frequently early childhood, are especially predisposed.

The prophylactic diet should be such as to favor soft passages and to prevent lodgement. It is impossible to lay down any fixed rule for any single ingredient of the diet. Even water, though expediting peristalsis, should not be used in excessive amounts as these might induce gastric dilatation, though scarcely intestinal. Fruits containing small seeds may cause diarrhoea in some per-

sons, while in others they regularly tend to accumulate, especially in the recesses of the colon, so that in elderly, constipated persons, they may be gradually discharged weeks after the corresponding berry season. In many instances, the relatively innutritious vegetables are theoretically indicated to furnish a large, soft, indigestible mass upon which the bowel may act efficiently but, if the mass surpasses the smallest calibre of the bowel, it establishes a dam against which finer debris accumulates and, even if this does not occur, excessive fermentation of cellulose may produce dilatation which ultimately results in obstipation. Tea and coffee may at times exert an astringent or even a paralysant action while, again, they may apparently cause diarrhoea.

Generally speaking, the prophylactic diet, should be fairly bulky, containing much fruit and soft vegetables, if there is neither marked stricture nor dilatation. If either of these complications exists, the solid food should consist largely of meat, milk, eggs and fine cereals so as to leave little residue, and due attention should be paid to any digestive defect. On the other hand, peristalsis should be favored by using considerable water, including soft, pulpy fruits. In either case, it is a serious error to seek a laxative action from fruits containing small seeds or from fruit or other foods, including sugar and syrups, which are laxative by virtue of the irritation of fermentative changes to which they predispose. In any case, the use of salines and of animal and vegetable oils, as cathartics, should be kept at a minimum. Purpetrol and, if necessary, cascara and other cathartic drugs should be employed as needed, the former almost as a routine.

When coprostasis has been established, the first question to be considered is the possibility of strangulation of the bowel wall. If this seems probable, no food should be given and, if hydraulic methods do not promptly relieve the obstruction, operation becomes necessary, so that the dietetic indication is negative, as already discussed.

In no case should violent cathartic treatment be instituted and, in the aged and feeble, the exhaustion of enemata may prove fatal. In many instances, digital or instrumental excavation of a faecal lodgment in the rectum may remove a dam and facilitate

the action of enemata to such a degree that cathartics may be safe and effective. Oil of peppermint etc., are of value as indicators of the establishment of a passage through the obstructing mass.

In cases of pure coprostasis, without fear of immediate lesion of the wall of the intestine, the slight additional mass derived from easily digestible foods, may be more than compensated by the gain in strength and it is often advisable to spare the patient's strength by prolonging the work of excavation and hydraulic measures over several days. If the lodgement is relatively high in the bowel, there is no objection to nutrient enemata and hypodermatic nutrition may be carried out, as well as inunction which may be united with massage to assist the emptying of the bowel.

Enteroptosis occurs mainly in the form of coloptosis, the extreme movability of the small intestine rendering it difficult to assign a limit between normal and abnormal location. There is a general impression that the various abdominal ptoses are usually or, at least frequently, associated as a general splanchnoptosis, but the author has seen only two or three cases in which the latter diagnosis would be supported, whereas nephroptosis occurs in about one woman in four in digestive practice and gastroptosis is also fairly frequent, though not so frequent as one would infer from the writings of those who confuse it with atonic gastric dilatation.

While pot belly does not alone justify the diagnosis of enteroptosis or of coloptosis, dietetic excesses, including excessive beer drinking, that habitually distend the alimentary canal with gas and that cause a deposit of fat in the abdominal wall, tend, both by increasing internal pressure and diminishing external muscular tonicity, to cause ptosis. However, it should be remembered that the normal support of the alimentary canal is due in part to its gaseous contents rendering it so light that it almost may be said to float in the abdominal cavity. Moreover, if the intestine contained no gas, the peristaltic propulsion of liquids and solids would be more difficult, since there would be no vis a tergo unless along a continuous mass of solids and liquids.

Even after enteroptosis has developed, care must be taken not to reduce the intestinal contents, either of solids, liquids or gases, to an undue degree, by exclusion of indigestible residue and fermentable foods. Such a course leads to so much contraction of the alimentary canal that the ptosis is increased and there is even danger of coprostasis.

CHAPTER XXXVI.

DISEASES OF THE HEART AND BLOOD VESSELS.

Various acute cardiac affections, especially endo- and pericarditis, are local manifestations of specific rheumatism, pneumococcic infection, infection with mitigated septic bacteria etc. Thus the diet should be that appropriate to fevers of this general nature.

Special pains should be taken to feed in the recumbent posture, preferably with the head turned to one side, and using a spoon, feeding cup with spout, a bent glass tube etc. So far as practicable, the diet should favor elimination by containing plenty of water although overfulness of the alimentary canal, too high arterial tension and overwork of the kidneys should be avoided. As straining at stool is a factor of danger, the diet should, so far as practicable, be laxative.

W. Howship Dickinson has emphasized that alkalies are more important than salicylates in preventing subsequent valvular lesions.

All of these indications are met by a cereal and milk diet, using fruit juices as beverages, but avoiding meat extracts and meat in any form during the acute stage, and also avoiding tea, coffee and chocolate.

Care should be taken, however, to avoid cardiac dilatation, various forms of myocardial degeneration and imperfect repair of acute valvular defects—so far as these are preventable—by nourishing adequately after the febrile stage has passed. This implies a relatively early return to semisolid and then to ordinary solid diet.

There is some reason to believe that cardiac degeneration, including even valvular disease, may develop from intestinal auto-intoxication, the dietetic prophylaxis and treatment of which

are discussed elsewhere. At any rate, the prevention of gaseous distention of the alimentary canal during either acute or chronic conditions of cardiac disease, is important. Even effervescent beverages should be used with caution.

The idiosyncratic origin—with special allusion to dietetic idiosyncrasies—of cases resembling if not properly included under angina pectoris, should be borne in mind. The cardiac rhythm and functional power are especially apt to be disturbed by tobacco, coffee, alcohol, and products of alimentary decomposition. Purin excess is a less conspicuous factor.

In chronic circulatory lesions, of various kinds, including valvular lesions, aneurysms, cardio-vascular degenerations etc., the two acute dangers are heart failure and vascular rupture. Hence excessive blood pressure or great fluctuations of blood pressure are to be avoided. Just as alternate hot and cold ingesta increase the effect of each extreme on the teeth and stomach, so the alternate relaxation and contraction of arterioles by tobacco and coffee or tea, may be more dangerous than the maintenance of a steady high pressure. The same principle applies to alcohol and tea, respectively, to irregular medication with nitrites and nitroglycerin, to balneotherapeutics etc.

A hearty meal, especially if of excessive bulk directly, or by containing effervescent liquids or substances that yield gas by inorganic chemic action, such as carbonates, or by fermentation, not only tends to disturb the cardiac action by pressure against the diaphragm, but to increase general abdominal pressure and hence, intrathoracic and even intravascular pressure. The last is also increased by relatively rapid absorption of water along with salts and sugars etc.

On the other hand, the physical and metabolic functions necessary to the digestion and assimilation of a hearty meal, may constitute an appreciable strain, quite analogous to that of excessive exercise, mental effort, emotion etc.

Aneurysms located along the oesophagus may be ruptured by the swallowing of large or hard boluses.

But, while chronic cardio-vascular lesions require care in eating, they also demand adequate nourishment. Thus, the

Tufnell treatment of aneurysm, though logical in so far as the physical rest and avoidance of alimentary strain are concerned, is illogical in that the close approach to starvation diminishes the coagulability of the blood and whatever tendency to repair may be present.

An abundance of gelatin and of lime are indicated to increase the coagulability of the blood in aneurysm. On the other hand, these patients generally manifest a tendency to calcareous degeneration which contraindicates the use of lime, so far as it is avoidable, unless for the urgent indication in case of aneurysm.

In practically all forms of chronic cardio-vascular disease, the diet should be adequate but not excessive, either in bulk or in the metabolic demands imposed on the system. Hence it should be relatively solid, including cereals, legumes, nuts, potatoes etc., but not the innutritious fodder vegetables, moderate amounts of eggs, milk and meat but not viscera. Both by choice of foods and methods of preparation, digestion should be rendered as easy as possible and thorough mastication should be insisted upon. Artificial comminution and predigestion should be employed if necessary. Fermentation and putrefaction should be avoided.

While sugar and starch are indicated on account of their production of energy, they should be used cautiously to avoid fermentation and the former especially because of the tendency to thirst and hence the ingestion of too much water, also because of the possibility of hepatic and pancreatic lesions interfering with glycogenesis and glycolysis. Tea, coffee etc., should not be employed unless there is a distinct indication for their medicinal use as heart tonics and diuretics.

The use of water and salines depends largely upon the presence of indications for elimination or the resorption of dropsical effusions. Even when these are present, there should not be too great deviation from the normal standard of about 3000 c.c. of total water, ordinarily implying the ingestion of 1000 c.c. as such. Nor should the ingestion of common salt vary much from the normal of about 10 grams. However, it should be remembered that only in extreme cases should surgical measures be adopted for the removal of dropsical effusions, and that the withholding of

salt, except in minimum quantity—that contained in the organic food stuffs—is almost as necessary as the restriction of water, to produce resorption of transudates. The diuretic, diaphoretic and cathartic removal of water, though largely medicinal, may be expedited by such dietetic measures as the use of fruits, of hot catnip and other herb teas, and saccharine and cellulose-rich fruits, respectively.

Angiosclerosis, mainly apparent and important as arteriosclerosis, may be prevented to some degree, by the avoidance or very temperate use of alcohol, tobacco, tea and coffee, the avoidance of malfermentation and putrefaction in the alimentary canal, as well as of dyspepsia in the most general sense, the avoidance of hard water, not to mention hygienic measures having no special connexion with dietetics.

After angiosclerosis has developed, the same precautions should be instituted to prevent, if possible, its further progress. The general dietetic management has been discussed.

Trunecek has proposed the use of a "serum" containing the inorganic constituents of blood serum, as a prophylactic and treatment of arteriosclerosis. Leopold Levi believes that this may be used internally and suggests the following modification:

℞	Sodium chlorid	10.
	Sodium sulphate	1.
	Sodium carbonate	.40
	Sodium phosphate	.30
	Calcium phosphate	.75
	Magnesium phosphate	.75

The above is divided into 13 parts, each of which contains the mineral ingredients of 15 c.c. of Trunecek's serum or 150 c.c. of human serum. Allowing for the introduction of salts in foods, the equivalent of 1000 c.c. of blood serum would be a fair average dose for a day.

The above formula has the following objections: it does not correspond accurately to the ordinary analyses of blood plasma, the carbonate in blood is due mainly to carbon dioxid in process

of elimination and hence is not an essential ingredient and the carbonate in the formula causes a precipitate; the lime is objectionable on general principles. Hence, the author has employed the following original modification:

℞	Sodium chlorid	5.54
	Sodium phosphate	.27
	Potassium chlorid	.36
	Potassium sulphate	.28
	Magnesium phosphate	.22

(or the last may be omitted and the sodium phosphate increased to 0.50).

The above may be considered as a close approximation of the mineral ingredients of 1000 c.c. of blood plasma and may be conveniently dispensed in 10 times this strength in solution with distilled water and further diluted as required. For instance, 20 times the amounts indicated may be added to the ordinary 2 liter bottle of distilled water, sold by various firms.

It is worth remembering that death from sudden heart failure, rupture of degenerated vessels, with or without macroscopic aneurysm, and including ordinary apoplexy, often occurs at or immediately after a meal. Hence it is important to avoid overloading the stomach, the concomitant use of alcohol, and such emotional causes as disgust at badly served food, anger, excessive merriment etc., which are very likely to occur at the table.

CHAPTER XXXVII.

BLOOD DISEASES.

Leucocythaemia is practically—and perhaps on sound theoretic principles—to be considered as a malignant neoplasm, differing from sarcoma mainly in the mobility of its cells. There is no authentic record of a cure, though improvement has been noted under arsenic and other older methods of treatment and Roentgen rays have produced marked, possibly permanent, improvement. Some acute leucocythaemias seem to be infectious and while all such cases reported have died, there is the theoretic possibility of cure, under this etiologic hypothesis.

While, at present, the dietetic or other treatment of leucocythaemia is discouraging, there is a general indication for administering an abundance of easily digested food, predigesting if necessary.

Pseudoleucocythaemia has variously been regarded as a tuberculous or other form of adenitis or as a form of sarcoma and hence analogous to leucocythaemia. The occasional occurrence of mixed types of leucocythaemia and pseudoleucocythaemia, favors the latter view, though, doubtless, tuberculosis and other conditions are included in the clinical diagnosis. The same remarks as to prognosis and diet apply here, as in the case of leucocythaemia.

(Hyper) Leucocytosis, is an indication of inflammatory, especially septic, inflammation, various forms of haemorrhage etc., rather than a clinical entity. The diet should be applied to the underlying condition. Two cases of the author, proved to be due to scurvy, contracted in the midst of abundance, simply on account of a dislike for fresh vegetables and fruit.

Leucopoenia, is frequently found in delicate adults and children, who have no special disease but who lack vitality and

strength. To what degree the blood condition is the cause and to what degree it is the effect of the general cachexia, is not decided. These cases are to be treated mainly on hygienic and dietetic principles. Cold spinal douches or sponges, and vigorous rubbing are of especial value, particularly in children. The diet should be easily digested, varied and abundant and should include a rather liberal supply of meat. There is a rather hypothetic indication for nucleins and purin-containing foods, such as the various viscera.

Anaemias. While it has been demonstrated that iron is at least absorbed and probably assimilated when administered in inorganic forms, the best form of iron is haemoglobin or some closely related compound. Various proprietary preparations are on the market, including bovinine which is essentially a preserved blood. If a slaughter house is accessible, fresh blood can be obtained every day or two and as much as a tumblerful may be taken daily. The taste is not disagreeable but most patients have an aesthetic repugnance toward it which can only occasionally be overcome. Meat is, on the whole, the best form of administering iron and, usually, patients who continue anaemic on a liberal diet containing 200—300 grams of meat daily, will not improve on any concentrated preparation of haemoglobin or iron. In other words, anaemia is not a special form of starvation but a failure of assimilation.

Red bone marrow and spleen may be used to stimulate haematopoiesis but they are by no means invariably successful.

Some authorities consider the diminished alkalinity of the blood the main factor in at least certain forms of anaemia. Some go so far as to speak of the blood as acid but it is never so during life in any but a transcendental sense. The measurement of the alkalinity of the blood is a tedious chemic process. For clinical purposes, it may be held that if the 24-hour urine has an acidity of 35 degrees, the blood is sufficiently alkaline but that if the urinary acidity is more than 50 degrees, alkali is needed in the system. (35 degrees of acidity means that any given amount of liquid, usually 10 c.c., is neutralized by 35% of its volume of decinormal alkali solution. For the present purpose, phenol phthalein should

be used as an indicator and the reading made at the first appearance of a faint but unmistakable pink tint.)

Sodium bicarbonate, about a teaspoonful daily, or various fruit juices, acid in themselves, but decomposed into alkaline carbonates in the body, may be used to counteract excessive acidity.

Certain cases of pernicious anaemia are associated with achylia gastrica, while other cases of either condition may occur without the other. Other cases of pernicious anaemia, so-considered, are characterized by intestinal putrefaction, signalized by indicanuria, foul smelling, gassy faeces etc. Anaemia accompanies Addison's disease and is undoubtedly due to failure of pancreatic and intestinal as well as gastric digestive power, or to a general failure of assimilative functions. Whether there is such an entity as pernicious anaemia, splenic anaemia etc., is doubtful. There is some reason to believe that hepatic failure explains both the enlarged spleen and the anaemia in the latter condition.

In any such case, the dietetic and other treatment should be directed toward what is believed to be the underlying condition.

Poly (Erythro) Cythaemia or true plethora, is a very rare condition, and no definite knowledge exists as to the dietetic management.

Chemic disturbances of the blood, including hydraemia, uraemia, cholaemia etc., are due to disturbances of other organs, chiefly the liver and kidneys, or to exogenic influences. While anaemic blood is relatively hydraemic, a practical as well as academic distinction must be drawn between such cases and those in which there is genuine failure to withdraw water from the system, mainly on account of renal failure. In the latter case, the kidneys themselves may be at fault, or the blood pressure may be low, mainly on account of cardiac weakness, or various combinations of lesions may occur. Such conditions will be discussed under the appropriate headings but the general indication may be stated to consist in the administration of an abundant, easily digested diet, as free as possible from purin bodies, oxalates etc.

In true hydraemia, which usually includes more or less water-logging (dropsy) of the body generally, the indication is to reduce

salines, especially sodium chlorid, to a minimum, so as to force the body to absorb liquid containing salts in solution, from the tissues. Meantime, very little water should be given. On the other hand, in relative hydraemia, without accumulation of water in the lymph cavities (including the serous sacs) rather liberal amounts of water and salts should be administered, sometimes by mouth, sometimes by rectum, sometimes hypodermatically, since well filled vessels and a blood capable of performing osmotic functions, even though deficient in cells, meet a large share of the demands on the circulatory function and tend to enable the system to repair the defect in blood cells.

CHAPTER XXXVIII.

HAEMORRHAGIC DISEASES.

Scurvy was formerly common among sailors, prisoners, inmates of poor houses and, under certain conditions, soldiers, on account of bad hygiene and deprivation of fresh fruits and vegetables. Whether this deprivation is the sole element or whether it is the basis of an infection, has not been definitely determined, nor has the exact operation of the deprivation, although the theory of Garrod and Ralfe that the disease is a dyscrasia due to lack of potassium and of carbonates derived from vegetable acids, is quite generally held.

Scurvy occasionally develops in individuals having no appetite for fruits and vegetables, especially chronic drunkards.

Whether the use of salt and smoked meats and fish is of etiologic moment or merely a circumstance of the deprivation of fresh foods, is doubtful.

Owing to the development of hermetic sealing, it is only through gross negligence or accident that scurvy now exists. Almost any kind of fresh or canned vegetable food, fruit juice etc., suffices to prevent or relieve scurvy.

In the treatment, it should be borne in mind that the patient is probably insufficiently nourished in various respects and may be on the verge of starvation so that the diet should be increased very carefully, as discussed under the latter head.

Infantile scurvy may develop in infants artificially reared on any kind of prepared food or on sterilized but not raw milk. It rarely appears before the fourth month, usually from the ninth to the eighteenth. It can be prevented by the use of a teaspoonfull of fruit juice daily. Its treatment usually includes careful attention to the diet of a badly nourished infant, aside from the scorbutic condition.

Purpura rheumatica and other forms of purpura depending on particular dyscrasias, require appropriate treatment.

Purpura haemorrhagica sometimes presents no sharp demarcation from haemophilia. The treatment includes the free use of gelatin, calcium salts and bland, abundant nourishment.

Certain cases of purpura—sometimes called purpura rheumatica—occur in tuberculosis and may even be the initial symptom. In such cases, aside from the immediate treatment, the diet appropriate for tuberculosis should be instituted.

CHAPTER XXXIX.

BONE DISEASES.

Rickets (this name being preferable to Rhachitis, whose etymology gives a false idea of the nature of the disease) is a disease due to general malnutrition and resulting in faulty growth of bone structure, the particularly conspicuous etiologic feature being deprivation of calcium and magnesium phosphate, resulting in failure of ossification. It is not hereditary in the strict sense that its existence in either parent tends to reproduce it in the offspring. It rather frequently, however, develops ante partum, apparently without regard to whether the mother is herself rickety or not, but owing to her present inadequate nutrition.

It is commonly stated to be rare before the sixth month but this statement apparently applies only to the conspicuous symptoms. It rarely develops after the eighteenth month but a late form is described occurring even from the ninth to the twelfth year.

Rickets is of frequent but isolated occurrence on account of bad nutrition of the mother during pregnancy or lactation or on account of inadequate artificial alimentation, in practically all parts of the world. It might almost be called endemic in European cities, among slum dwellers and especially in negroes and recently foreign communities in America, depending upon no true racial or geographic tendency but upon poverty, bad hygiene and poor nutrition.

Its occurrence in breast fed children should lead to examination of the milk—unless the general evidences of malnutrition of the mother are unmistakable—with a view to substitute feeding. Beef juice, egg yolk, peptonoids etc., as well as lime preparations, may be used to supplement either breast or artificial feeding. Cereal and saccharine foods should be used in relatively small quantities, though strained gruels are a valuable adjunct to diet and espec-

ially useful for diluting cow's milk. While lime salts are included in the various foods suggested, it is usually wise to administer them medicinally and also to employ minute doses of phosphorus in the elemental state, to stimulate osteoplasis. Adequate nourishment of the mother during pregnancy and lactation, is important.

Osteomalacia has been considered to be rickets in the adult due to resorption of lime salts after their primary deposition. This is probably too narrow a view, as there is actual degeneration of bony structure whose exact cause is not known.

Osteomalacia is, to some extent, dependent on local geologic causes, it is favored by unhygienic surroundings and especially by the drain of repeated pregnancy. It is relatively common in the insane, though perhaps overworked as an excuse for fractures in inmates of asylums.

There is a general indication for good feeding and hygiene, and a special one for lime salts and phosphorus, unless probably due to phosphorus poisoning but the prognosis is unfavorable.

Surgical Diseases of bone should be treated on the general principles applicable to fevers, sepsis, tuberculosis etc.

CHAPTER XL.

GENERAL PRINCIPLES OF FEEDING IN FEVERS.

Subject to individual exceptions, a febrile period of three or four days requires no organic nourishment, in an adult of average strength. Indeed, many patients are rather benefited by a fast which allows the emunctories some rest and stimulates the body to draw upon its store of fat.

In young children and old persons, especially of debilitated constitution, it is advisable to nourish throughout even a brief fever, unless, as in various intestinal diseases, assimilation is practically prevented by the conditions present and recovery is delayed by the embarrassment of the mechanic and chemic effects of food.

In any fever lasting more than a week, nutrition is important and it becomes more and more imperative as the limit of tolerance of inanition—40 days—is approached.

There seems to be an element of truth in the old, crude conception, that certain foods were "heating." The diet appropriate to most fevers is semi-solid, consisting of milk, cereals, meat juice—but not meat teas which contain almost no nutriment and, on the contrary, waste products—eggs, custards, fruit juices etc.

As a rule, fever patients should be fed every four or five hours, occasionally as often as every two hours. It is practically never advisable, under any circumstances, to feed oftener than this, except that any one meal may be divided by short rests.

Neither is it of appreciable value, unless merely to induce the patient to begin to eat, to introduce so small quantities as a spoonful of milk at a time.

The endeavor should be made in all cases in which nutrition is of serious import, to introduce 50 grams of proteid a day and a total amount of organic food corresponding to 2000—2500 calories.

However, the average patient has available 5—15 kilograms of chemically pure fat. The oxidation of 250 grams (¼ kilogram) daily, would yield approximately the total number of calories required. Thus, with the addition of 50 grams of proteid a day, the average patient should theoretically subsist 3—9 weeks on his own tissues.

Whether because metabolism is greatly increased in fevers or because of failure of lipases or because of other reasons not understood, nourishment by the patient's own fat is not an adequate reliance, even if sufficient proteid is given.

In all infectious diseases, aside from the necessity of disinfecting the discharges, clothing, bedding etc., and of maintaining quarantine in many infections, it is important to prevent the food and drink of the patient, his eating utensils and the passage of trays to and from the sick room, from being means of conveying infectious matter.

All remnants of food should be destroyed, preferably by fire, placing them in paper bags, which are burned with due precautions against spattering from explosions of steam before the temperature has reached a point sufficient to kill germs. This precaution is particularly important when cookstoves and hot-air furnaces are used as crematories.

Table utensils, napkins etc., with analogous precautions, should be stertilized by boiling for ten minutes or more.

While the principle that one cannot spoil bad eggs applies to some degree to the danger of conveying infection to the patient himself, the possibility of introducing germs of an independent disease, as in hospitals and, more generally, of introducing saprophytes which will cause complications in the stomach and intestine, should be borne in mind. Thus, while it is rather far-fetched to boil the water for a typhoid patient, unless there is danger of other contamination, the ordinary principles of asepsis and cleanliness applying to food and drink, should be enforced for fever patients.

Unless in a window box or refrigerator, or proper receptacle, food should never be kept on hand in the sick room.

For her own protection, the nurse should be careful not to

taste food that might have been contaminated from the patient, not to eat without first carefully cleaning her hands and it is better that she should not eat at all in the sick room.

Particular care is necessary to avoid refusal of food or reflex inhibitions of digestive secretions, by offending the aesthetic sense of the patient in any way. Hence, nourishment should always be served in a cleanly and dainty manner, and not immediately after defaecation.

On the other hand, feeding in fevers is usually a serious business and, until convalescence sets in, a distinct appeal to the appetite is usually unnecessary.

The various flour pastes and slops commonly prescribed in cook books for invalids are of little value.

Convalescence From Fever. A Sample Dietary.

1st day. Breakfast: Poached egg on toast, cocoa.

Lunch: (about 4 hours after breakfast) Milk with bread, crackers or cereal or milk punch if indicated.

Dinner: (4—6 P. M., according to time of breakfast) Oyster stew with crackers, buttered toast, very weak tea or coffee.

Supper: (7 or 8 P. M.) Milk toast, or split Boston crackers toasted, buttered and moistened with tea. Wine jelly.

2d day. Breakfast: Soft boiled egg, omelet, or jelley omelet. Weak coffee. Half orange or grape fruit, juice alone swallowed.

Lunch: Cup custard.

Dinner: Chicken panada, toast, gelatine jelly with whipped cream.

Supper: Toasted soda crackers with butter, tapioca pudding.

3d day. Breakfast: Scrambled eggs (1 or 2), shredded wheat biscuit with canned peach, fresh strawberries and cream, cocoa.

Lunch: Chicken broth with saltines.

Dinner: 1 broiled lamb chop, mealy baked potato, French bread and butter, weak coffee, fruit jelly.

Supper: Buttered dry toast, baked apple and cream.

4th day. Breakfast: Hominy, rice or farina and cream. Very small piece of bacon, creamed potato, cocoa.

Lunch: Baked or boiled custard, hot or cold, with sweet wafers.

Dinner: Rice soup, reinforced with somatose powder or other proprietary proteid if desired, small piece of tender beef steak, potato puff, chocolate pudding, small orange.

Supper: Milk toast, wine jelly.

5th day. Breakfast: Some other kind of cereal with cream, broiled lamb chop, dry toast (vary the bread from time to time), weak coffee, banana with pine apple juice.

Lunch: Junket and wafers.

Dinner: Chicken soup with new kind of crackers, creamed sweetbreads, macaroni, cocoa, jelly or canned peaches and cream.

Supper: Buttered dry toast, orange jelly, sponge cake.

6th day. Breakfast: Broiled fish, toasted boiled potato, stewed prunes with cream, rejecting skin.

Lunch: Beef broth with croutons, crackers.

Dinner: Escalloped oysters, ice cream, wafers or macaroons.

Supper: Lamb chop, Duchess potatoes, fresh fruit (rejecting skin, core, and seeds), cocoa, vegetable oysters.

In cases that have been upon an exclusive milk diet, the addition of solid food may be scheduled as follows: (Adapted from W. G. Thompson. It is not intended that such a schedule should be slavishly followed.)

1st day: Chicken broth thickened with rice, for one feeding.

2d day: Milk or cream toast, one or two feedings; or broth as before for one feeding, milk or cream toast for another.

3d day: Scraped beef sandwich about noon; soft egg or baked custard early in evening. (The beef should be broiled on a hot plate.)

4th day: Soft parts of three or four oysters, meat broth thickened with beaten egg, cream toast, rice pudding without raisins.

5th day: Scraped beef sandwich, tender sweetbread, bread and milk.

6th day: Farina and milk, rice pudding or blanc mange with whipped cream, soft boiled egg and dry toast.

7th day: Omelet, Bavarian cream, toast or crackers.

8th day: Tenderloin steak, boiled rice, wine jelly, sponge cake, add toast or crackers to various meals.

9th day: Tender roast beef, mealy baked potato, orangeade. Add dry bread toast, various kinds of crackers, toasted or not and soft cereals including nearly all breakfast foods except oatmeal and gritty wheat preparations, to this and subsequent rations.

10th day Lamb chop, or baked or broiled fish or very small piece of boiled ham, baked, creamed or toasted boiled potato and simple desserts about as on previous days. Substitute chicken breast, squab or tender but unspoiled game or stewed or baked or raw oysters for meat. Aim to secure variety of foods without departing from the general kinds mentioned.

Foods to be Avoided in Conditions of General Weakness, Fever, and Especially in Various Forms of Indigestion.

(Modified from W. G. Thompson.) Rich soups, gravies and sauces. Pickles, radishes, olives and other relishes and strongly spiced foods. Fresh, soft breadstuffs which form a tenacious bolus; hot breads, pastry, especially the under crust of pies, pastry, unless light and flaky and, at the same time, not too "short," i.e. greasy; most cake, although sponge cake and cookies are often allowable, griddle cakes and waffles, doughnuts, muffins, though popovers and similar light preparations of flour and egg may be used. Raw vegetables, such as celery, coleslaw and others included under relishes. Most roots and tubers, though potato and sometimes sweet potato especially baked or toasted, may be allowable. Legumes, unless made into meal and cooked or in purees which are relatively free from cellulose. Crustaceans. Preserved meats in general, though bacon, salt pork and boiled ham are often allowable. Duck, goose, wild fowl, rabbit and most game, veal, pork. Hash, ragouts, stews from previously cooked meat, warmed-up foods generally, although there is no objection to potatoes being creamed or toasted after previous cooking. Fried foods generally. Cheese and fresh tough curd. All skins, seeds, core scales etc., unless very fine. Tea, coffee, beer, alcoholic beverages generally unless especially indicated.

While there is a very general prejudice against sugar, candy, nuts, fat meat etc., these are very valuable as energy-producers and may often be used to advantage.

CHAPTER XLI.

INFECTIOUS AND PARASITIC DISEASES. INFECTIONS USUALLY OCCURRING IN CHILDHOOD.

Mumps.

The diet in mumps and other infections usually involving children, should obviously correspond in a general way to that appropriate to this age. Even the sick adult should be considered as a child, since the wide range and indigestibility or toxic action of many of the food stuffs and adjuvants to food commonly used by healthy adults with impunity, render it advisable that the diet should closely approach the simple foods of childhood.

Mumps is seldom severe enough, in temperature, liability to renal involvement, general symptoms, or duration, to require a very strict diet. However, on account of the necessary confinement and lack of exercise, it is best to limit the food mainly to milk and cereals. Tea, coffee, alcoholics, spices etc., are contraindicated by the tendency to orchitis and oophoritis, which renders any possibility of hyperaemia of the genito-urinary tract undesirable.

Baked apple with cream, apple-tapioca pudding, jellies etc., may be used. Fruit juices, such as lemon and orangeade, are theoretically indicated but often cause severe pain on account of the salivary stimulation. For the same reason, any distinctly sapid or hot food or drink, may be contraindicated.

In many cases, the parotids are so painful that the ordinary movements of mastication and deglutition are intolerable and the diet must be limited to milk, weak cocoa, broths etc., taken through a bent tube.

Measles, Roetheln, Varicella etc.

In the mild febrile diseases generally, the staple diet is milk and cereals, including bread and crackers preferably toasted, oyster

stew occasionally and the simple desserts mentioned for mumps. Four or five meals should be given daily. An abundance of boiled water, flavored if desired, with lemon, orange and various other fruits, should be given.

Scarlet Fever.

In uncomplicated, mild cases, the diet is the same as for measles etc. Severe cases require careful dietetic management on three principal grounds:

1. The necessity of maintaining strength;

2. Throat complications, the dietetic management for anginose cases being the same as for diphtheria;

3. Renal complications which, indeed, must always be considered as imminent.

The diet appropriate for fevers in general, does not irritate the kidneys. If there is marked renal involvement, considerable but not too much water should be given, say 1—2 quarts, in all, daily, for an adult, two-thirds as much for a child of ten.

Convulsions, persistent vomiting or other interference with deglutition indicates the use of physiologic salt solution by bowel or subcutaneously. The use of hot saline enemas to stimulate the kidneys, is rather therapeutic in the general sense than dietetic.

A happy mean must be followed between insufficient nutrition and alimentary embarrassment.

Purin-containing foods, fruits rich in oxalates etc., are especially contraindicated.

Diphtheria, Anginose Scarlatina etc.

In all diseases in which the throat is involved in an infectious process, sprays or gargles of hydrogen peroxid or some similar cleansing agent are indicated, before and after feeding.

The painful and swollen condition of the throat usually requires an almost exclusively liquid or pultaceous diet, as of milk,

eggnog or soft custards, cereals soaked in milk, meat juice etc. Both the local lesion and the seriousness of the disease interfere with the sense of taste and enjoyment of food, so that, except that the nourishment should be neatly served, little attention need be paid to stimulating the appetite. Indeed, the patient will usually regard the food in the same light as medicine and will take it only as a means of treatment.

Especially in genuine diphtheria, the danger of cardiac paralysis demands that the head should be raised as little as possible. A feeding cup with a spout or a drinking tube should, therefore, be used or, if the patient insists on using ordinary utensils, he should be fed from a cup or spoon, while lying on the side, so as to prevent the danger of food entering the larynx, an occurrence whose danger lies not so much in the probability of direct asphyxiation as of strain from coughing.

In order to conserve the patient's strength as much as possible, the following routine should be observed: spraying the nose and throat, feeding, medication, repetition of spraying, bathing or other attention to the patient and his bed, quiet in a dark room for four hours or a little more at night.

If the condition of the throat prevents the swallowing of adequate amounts of nourishment, recourse should be had to gavage through a buccal or nasal tube, or to rectal nutrition. The introduction of food into the upper part of the alimentary canal is necessary to complete digestion and thus, gavage should be preferred if it does not disturb the patient too much.

Predigestion of food may be practiced in any of this group of infections, although it does not amount to much.

In all cases of diphtheria, anginose scarlatina and even septic involvement of the throat, great care should be taken not to produce secondary lesions with any of the utensils or instruments employed and, for the same reasons, hypodermatic nutrition is to be regarded as a last resort.

Pertussis. Perhaps not a specific entity but a manifestation of influenza or other bacteria colonizing mainly in the larynx. See general discussion of respiratory diseases.

Variola. Diet as for scarlet fever or sepsis.

Typhus Fever. Diet about as for typhoid but somewhat more liberal. The old treatment at Bellevue was to administer egg nog etc., in abundance, feeding from a watering pot.

Cholera Asiatica, Dysentery, Amoebic and Bacillar. See discussion of intestinal diseases.

Yellow Fever. The comparatively short duration of the disease renders stimulation more important than nutrition. Moreover, the morbid anatomy necessarily interferes with assimilation and the haemorrhages and vomiting often render it futile to attempt to feed. However, some authorities hold that nourishment should be forced and point to favorable results both with adults and with breast fed infants, by persisting in regular feeding.

Gelatin is theoretically indicated by the haemorrhages and hypodermoclysis or rectal administration of salt solutions are appropriate.

During the stage of calm, poached eggs on toast, custards, beef juice, peptonized milk etc., should be administered as liberally as possible but at least two hours should be allowed between feedings.

Malta Fever and Relapsing Fever. Diet as for typhoid, with less necessity of guarding the alimentary canal during the fever and with greater freedom in the remissions.

Pneumococcic Disease. Feed about as for typhoid, with less restriction to fluids. Salines, including the saline laxatives and sodium chlorid should be given abundantly to combat the tendency to coagulation. See discussion of respiratory diseases.

Erysipelas. Light, semisolid diet tending toward that for sepsis.

Rheumatism. (**Acute Infectious.**) Milk, cereals, no meat, abundance of fruit juices, but not fruits containing oxalates. Cranberries, on account of containing benzoic acid, may be given. Alkalies. It should be borne in mind that the urine is by no means always excessively acid or concentrated or surcharged with urates. Yet there is generally an indication for the administration of an abundance of water, as in lemonade and orangeade.

Hydrophobia, Tetanus, Anthrax, Equinia, Malignant Oedema.

On account of the bad prognosis, no treatment is liable to be successful. In the first two, the convulsive tendencies often contraindicate the introduction of food or drink but salt solution may usually be given by the bowel. In order to minimize the tendency to convulsions, all food and drink should be of the body temperature, unless extremes of temperature are craved and well borne. Peptonized milk may usually be given if water can. It may be found that introduction of food or water by stomach tube is better borne than attempts at swallowing. If the jaws are locked, it may be advisable to extract a tooth or two to allow the introduction of a feeding tube or stomach tube, or the nasal stomach tube may be employed. In the last three diseases, the diet is as for sepsis.

Filariasis. No special regimen.

Influenza. Treat as for any mild febrile affection.

Chancroid. Diet about as for gonorrhoea, in order to allay any erotic tendencies that may be present.

Gonorrhoea. See Urinary Diseases.

Bubonic Plague. Diet as for sepsis.

Dengue. The severity of the fever, its short duration and the almost invariable recovery, render it advisable to administer little or nothing during the fever, except water, fruit juices etc., although there is no objection to employing peptonized milk, broths, or the standard diet for typhoid, if tolerated.

Non-Specific Sepsis. An abundant semi-solid diet should be employed. Milk, cereals, egg nog, custards, eggs on toast, tender steak, chops, chicken breast etc., are the main stays. Moderate amounts of alcohol are allowable to stimulate gastric secretion—1—3% of alcohol in a feeding. Four or five meals should be given in 24 hours. Predigestion should often be practiced or digestants may be given immediately after the meal.

Trichiniasis. This form of cysticercus disease is due practically solely to ingestion of raw or imperfectly cooked pork.

Smoking, salting etc., do not kill the trichinae. Hence the invariable rule should be followed, by everyone, to eat no pork of any kind, that has not been cooked thoroughly, to the center. If this rule is followed, the presence of trichinae in the meat apparently does no harm. There is no special regimen for the disease itself.

Malaria. During the febrile periods, nutrition may be suspended or modified to conform to the standard for fevers generally. In the intermissions or remissions, an abundance of easily digested food should be given. On account of the anaemia, it should be relatively rich in meats or blood or one of the organic preparations of iron should be given. Various bitter stomachics may be employed.

Beri Beri, has variously been ascribed to mouldy or otherwise contaminated rice, to specific bacteria not necessarily, according to some authorities, conveyed by foods, and to a systemic state the opposite of scurvy, due to lack of meat foods and superabundance of vegetables in the diet. While meat-eating peoples do not develop the disease endemically and are usually less susceptible to it in its geographic habitat, various accidental causes and prophylaxis along other lines are sufficient to account for the difference and the disease is probably a specific infection. Even so, it is probably carried by foods, especially rice, and an avoidance of suspicious sources of supply is wise. A liberal dietary, rich in proteid and containing at least small quantities of meat is also appropriate.

Chronic Granulomatous Infections.

Syphilis. This disease requires no special dietetic treatment and the vegetable extracts reputed to be of value as alteratives are doubtfully so. At certain periods, the diet for mild fevers is appropriate. Otherwise, an abundant, nutritious and easily digested diet should he employed. It is advisable to cleanse the mouth and throat with weak bichlorid solution, before eating, if there are local lesions.

There is probably no necessity of avoiding acid drinks and fruit during mercurial treatment.

The occasional development of stomatitis from too vigorous use of mercury, calls for dietetic management as for stomatitis of similar grade from other causes.

The tendency to vascular and visceral lesions, contraindicates tea, coffee, alcohol etc., and, if there is probable danger of rupture of vessels, especially in the central nervous organs, overloading the stomach, eating indigestible foods and various other dietetic excesses may prove disastrous.

On account of the tendency to leucoplakia and other local lesions in the mouth and throat, the use of tobacco should be forbidden.

The greatest care should be taken to avoid infection of others from table utensils etc. Fortunately, this danger is not very great, since syphilis is so prevalent and carelessness in washing dishes so common in restaurants and hotels, that if the infectious agent were readily transmitted or else not easily killed, syphilis insontium would be almost universal.

Leprosy has been repeatedly declared to be due to a fish diet but the general consensus of opinion is against this view and in favor of transmission of the bacillus by ordinary contact, and indirectly as in tuberculosis. While generally considered incurable, the disease is of long duration and theoretically requires a liberal diet. However, wherever it is prevalent, lepers are usually badly cared for in all respects and, from one point of view, there is little to be said in favor of any means that will prolong life.

Actinomycosis. See Chapter XVI. p. 135.

There is no special regimen for the disease itself.

Diseases due to Entozoa. See Chapter XVI. p. 133, 134.

Typhoid Fever.

From the dietetic standpoint, it should be remembered:

1. That typhoid fever lasts three to five weeks or more, so that nutrition is a matter of life or death;

2. That, during the second week, there is a considerable degree of inflammation of the small—occasionally also the large—

intestine, culminating in actual ulceration during the third week, so that perforation, haemorrhage and ultimate cicatrization are possibilities;

3. That, aside from the local lesions, there is a systemic infection, increasing catabolic waste, producing general intoxication and depressing the digestive secretions and the functions of the body generally;

4. That there is also an intestinal intoxication, due not so much to the typhoid bacillus as to the colon bacillus and other indigenous germs whose virulence is heightened, partly by the increased temperature, and that this intestinal intoxication is not only serious in and of itself but by lessening the resistance to the specific bacilli; and that this intestinal intoxication is largely controllable.

No other fever common in the United States demands, at once, so full nutrition and so careful guarding of the alimentary canal against local irritation.

While the danger of perforation of the intestine is always present and while there is a contraindication to harsh, indigestible and irritating foods, there is little danger of puncture, even of an ulcerated Peyer's patch, by any ordinary food. An undigested milk curd is more solid, and more irritating in its decomposition products, than bread, crackers, soft cereals etc., which become pulpified in the stomach, and quite as much so mechanically as meat, hard boiled eggs etc.

It is impossible to annihilate the typhoid bacilli in the blood or even to destroy the ordinary flora of the intestine, by any known antiseptic or aseptic treatment but, by using certain selected internal antiseptics, as salacetol and acetozone, by keeping the lower bowel reasonably well flushed, by moderate use of mercurial and saline cathartics, and by suitable diet, we can reduce intestinal saprophytosis to a minimum.

Ordinary, prolonged, clinical typhoid, is true typhoid plus colon bacillus intoxication (including with the colon bacillus, the other bacteria of the bowel). Pure typhoid infection should not

have a febrile stage of more than 2½ to 3 weeks, the temperature should not rise, except briefly, above 103; there should be no septic complications, including pneumonia; and there should not be an exemplification of what is known generally as the typhoid state.

The constant use of a single nutriment, such as milk, meat extracts etc., tends to produce virulence of special strains of bacteria, notably of the colon bacillus and bacillus lactis aerogenes.

One liter of milk daily (a little more than a quart), the old standard ration, furnishes approximately 40 grams each of proteid, fat and carbohydrate and yields about 700—750 calories. To furnish the necessary number of calories, about 3 liters of milk are required, involving a relative excess of proteid, water, and fat and a relative deficiency of carbohydrates, especially as there is likely to be a laevulosuria from failure to oxidize the inverted lactose.

One liter of expressed meat juice furnishes about 70 grams of proteid and a negligible amount of other organic foods, and yields only about 350 calories. Beef teas made with heat above the coagulating point of albumin contain practically no nourishment, except a little gelatin and, while the extractives of an organic nature are stimulating, they are essentially urinary waste products and are not only toxic but tend still further to embarrass the emunctories. Such preparations, therefore, can not be relied upon for nutrition but may be allowed occasionally to secure variety and as stimulants.

A fair average diet in typhoid, consists of 1250 c.c. of milk and 400—500 grams of cereal, or approximately a pound. Shredded wheat, rice, farina, crackers and toasted or dry bread may be used to secure a variety of cereals.

The foregoing ration may conveniently be divided into five feedings, each consisting of about a cupful of milk and the equivalent of four good sized soda crackers. A shredded wheat biscuit weighs 30 grams and a standard roll 60 grams, a slice of bread about 25—50 grams.

In order to stimulate the appetite and gratify the patient, as great a variety of cereals should be given as possible and the milk should be given in different ways, for example hot or cold,

ice cream, combined with enough weak tea, coffee or cocoa to flavor it, combined with eggs as raw, baked or boiled custard. Beef juice or extracts known to contain reasonable proportions of nourishment, may be used once a day. Fruit juices, and jellies may be used in small quantities. Gelatin may also be employed, variously flavored and with whipped cream, custard sauce etc., especially if there is haemorrhage. Gruels may be used if agreeable to the patient.

Various proprietary milk foods, artificial preparations of proteid etc., may be used as substitutes for milk.

Diet in Convalescence.

Serious symptoms, or even perforation and death in typhoid fever, have been ascribed to a bite of fruit, a small morsel of bread etc. Such occurrences are probably coincidences.

At the same time, it is unwise to allow a sudden change to an ordinary diet during canvalescence from typhoid and, the more restricted the diet has been during the course of the disease, the more gradually should it be increased.

As a general rule, the diet should not be changed until one week after complete defervescence, although an occasional—not daily—rise to 99 or 99.5, may be disregarded.

If the patient has been on the old-fashioned milk and broth diet during the febrile stage, the convalescent diet should, at the beginning, be about the same as that herein advised for the febrile period. Thus, the dietaries according to the respective plans of treatment will be about as follows:

Old Method.

1 2 3 4	5 6	7 8	weeks.
Milk and broth	Cereal-Milk	Light diet	Full diet.

New Method.

1 2 3	4 5	weeks.
Cereal-milk etc.	Light diet	Full diet

Light diet following the cereal-milk diet already described, is about as follows: For the first day or two, a poached egg on toast, for one meal a day; then a small portion of chicken breast, a broiled chop or equivalent in steak, roast beef or possibly boiled ham, for one meal a day; in the last two or three days of the week, baked apple, gelatin desserts, cereal puddings, fruit sauce, free from seeds, sponge cake, ginger or sugar cookies, baked or mashed Irish or sweet potato. More liberal use of eggs, discontinuance of milk which has probably become distasteful. Oyster stew may be allowed in the week of light diet.

It should be understood that "full diet" following the week or ten days of light diet does not mean that the patient is to plunge into all sorts of excesses either of quality or quantity. At the same time a genuine craving is not to be refused without good reason.

Any febrile or digestive disturbance occurring after the diet has been increased should lead to a return, for several days, to a pretty strict regimen.

The routine use of alcohol during typhoid is to be deprecated but 1—3% (teaspoonful to tablespoonful of whisky or brandy to the cupful of milk) acts as a gastric stimulant and may be used as necessary. While alcohol probably always acts as a circulatory depressant, except as it relaxes arterial tone before it does that of the heart, it is a fuel-food to the extent of furnishing 7.1 calories per gram and nearly 30 c.c. can be given daily, in small amounts, without passing the power of the body to oxidize it.

Entirely aside from its use as a food or drug, alcohol should be allowed in small amounts, quite regularly, in all patients in whom previous custom has produced tolerance and the danger of delirium tremens

Similarly, there is no objection to allowing small quantities of tea, coffee and chocolate, as drugs, to support the heart or on account of habituation. While acute sickness usually removes the taste for tobacco, if abstinence produces severe nervous symptoms, moderate indulgence is advisable. Ordinarily, however, even an inveterate smoker will not care to indulge until convalescence has begun. Thus the return of the craving for tobacco is,

generally, a favorable prognostic. The advisability of taking advantage of the opportunity to discontinue all similar bad habits, should be seriously considered.

Diet in Tuberculosis.

The site of the lesion of tuberculosis has no bearing on the dietetic indications but may interfere with the fulfillment of these indications or present special difficulties.

In tuberculosis with open lesions of the respiratory passages or otherwise tending to the presence of bacilli in the mouth and pharynx, pains should be taken to prevent the swallowing of sputum and other discharges and the mouth and pharynx should be cleansed with hydrogen peroxid, boric acid, borax and similar mild antiseptics before meals.

Certain tuberculous foci of the larynx, fauces, tonsils etc., cause dysphagia and may require local anaesthetics before meals or even gavage. As a rule, if swallowing is exceptionally painful, the use of the tube is also intolerable. In such extreme cases, the prognosis is usually so bad as to render it unwise and cruel to urge feeding too strongly.

Tuberculosis of the stomach itself is very rare and either does not interfere particularly with feeding by the mouth or the case is so hopeless that starvation may be regarded as a form of euthanasia.

Tuberculosis of the intestine is important in a double way. From the stand point of etiology and prophylaxis, it should be remembered that tuberculosis from infected ingesta, especially milk, is relatively more frequent in infants and children than in adults. Some authors have gone so far as to claim that most tuberculosis, even when involving the respiratory passages, is of ingestive rather than inspiratory etiology. While animal experiments have shown that it is possible for tubercle bacilli to be absorbed from the intestine, without producing a local lesion and subsequently to produce lesions elsewhere, there is no substantial evidence against the respiratory route in tuberculosis and it is certainly far-fetched to hold that pulmonary tuberculosis in the adult is due to intestinal infection that has lain dormant since child-

hood. At the same time, the importance of excluding tuberculous sputum, food etc., from the ingesta is obvious.

An established intestinal tuberculosis almost invariably implies intestinal ulceration, with the possibilities of perforation or of cicatrization and obstipation. Hence the diet must be appropriate to these lesions and to any surgical intervention that may be necessary.

Tuberculosis of the meninges may cause paralysis or convulsions which interfere with deglutition, the dietetic management being as for similar conditions of other cause.

Otherwise, tuberculous lesions do not usually cause any direct disturbance of digestion or call for special management.

Tuberculosis, being neither self-limited nor semelincident, and any specific antitoxic or antibacterial action being supported only by theoretic conclusions from animal experiments, the treatment of the disease is limited, at present, to measures directly and exogenically antagonistic to the bacilli (such measures being unsatisfactory) and to measures which increase the vitality and resistance of the cells of the invaded organism.

Hence, in tuberculosis, diet becomes of relatively high importance. There is a general indication to feed abundantly, both with food which replaces waste and that which furnishes energy.

Mere increase of weight in tuberculosis is not indicated by any theoretic conception of the nature of the disease and, empirically, is not a guarantee of favorable progress.

In seeking a basis of special diet in tuberculosis, we have two valuable scientific facts, though both rest largely on empiricism:

1. Gouty patients or those corresponding to the former conception of the uric acid diathesis do not usually contract tuberculosis.

2. Pulmonary tuberculosis is shown by actual experiment to be literally a consumption, there being a greater degree of oxidation in the blood or tissues than normal, so that the ratio of eliminated carbon dioxid to inspired oxygen, is increased. There is also, on the average, more wasting of fat than would be expected from the general features of the infection.

Hence, there is an indication to increase proteids and also purin-containing foods up to the limit of tolerance. Urea has been used in the treatment but there is very little theoretic or practical support of this practice. Liver, kidney, thymus, perhaps even spleen should be used to a moderate degree, subject to the patient's appetite, and various nuclein preparations should be administered.

Both fats and carbohydrates should be used freely but the former, especially, should not be crowded to the point of disturbing digestion or nauseating the patient.

Contrary to general opinion, the writer holds that there is no special virtue in cod liver oil itself and it is at least not established that any of the waste products of hepatic catabolism in the fish have any special action against tuberculosis. On the contrary, hepatic waste, in general, is relatively highly toxic and it embarrasses the emunctories.

While it is true that the biliary salts favor the absorption of oils and fats, there is no evidence that these salts are deficient in tuberculosis and, if there is any special reason for administering them, they may be better given in pure form.

In children especially, a tolerance for cod liver oil, often consists essentially in a growing appetite for the liquor with which it is so often combined.

Generally speaking, butter, cream, Mayonnaise, salt pork, ham, bacon, cocoa, butternuts etc., are more available as fatty foods than cod liver oil and 100 to 150 grams of fat daily should be given.

Remember that while pure petrolatum (purpetrol, not the ordinary commercial forms) may be indicated as a laxative or in combination with bismuth etc., as an internal emollient, no form of mineral oil is capable of assimilation, advertisements of certain proprietary preparations notwithstanding.

Carbohydrates in the form of starchy foods, good candy, chocolate etc., should be used liberally.

Remember that bread, including various other breadstuffs, is the staff of life and that butter has been called its golden head. This combination is especially to be desired in tuberculosis.

It has been claimed that the immunity of sheep to tuberculosis is due to the fact that their special fat acts in some way injuriously to the tubercle bacillus. At any rate, the inunction of lanolin to the amount of 30—50 grams a day is feasible and harmless.

It is also possible that the resistance of goats to tuberculosis may depend upon some special principle that enters the milk and which is conspicuous by its absence in cow's milk. Hence, there is a general indication, upon which too much hope should not be based, for using goat's milk in tuberculosis.

Barring special lesions and exceptional conditions, tuberculous patients may be considered in two categories, so far as dietetic and hygienic treatment are concerned: Those having a pneumonic or other rather acute febrile condition and those whose temperature does not vary much from the normal and who are able to be about. The former should be kept in bed and dieted as for other fevers, except that the strict attention to local conditions as in typhoid is not required. The latter, on the contrary should be kept mostly in the open air and should take light though never fatiguing exercise and should have the liberal diet already described.

Never stuff a tuberculous patient, either by administering unreasonably large quantities of food, or too frequent meals (three, four or possibly five, are the right numbers) or by giving freak preparations of nourishment.

Do not expect miracles of some climate different from that to which the patient is accustomed. Indeed, if the home climate is fairly dry and not too inclement, it is unnecessary to incur the expense, trouble and nostalgia of a removal. If the patient does seek another climate, he should be impressed with the necessity of treatment and freedom from hard work, mental or physical. A patient in a hopeless stage should not be sent to a distant place.

Owing to the practical impossibility of segregating the patient if he eats at the table with the family, his meals should be served separately and the general methods of disinfection should be applied, as discussed in another place.

CHAPTER XLII.

RESPIRATORY DISEASES.

The milder colds require no special dietetic treatment but it is advisable to adhere somewhat closely to the diet appropriate to mild fevers in general, bearing in mind the usual indication in persons of good circumstances, to secure a fast whenever possible. A good rule is to "starve a cold and feed a fever"—meaning by fever, typhoid or some similar infection of considerable duration.

Water and fruit beverages are especially indicated. At the inception of a cold, a hot bath, abstinence from food and the use of 2000 c.c. of very hot saline solution, lemonade, orangeade etc., in the course of two or three hours, will often abort the cold.

Hay Fever and Asthma are sometimes excited by some special article of diet, such as shell fish, toward which the patient manifests an idiosyncrasy. (See list under Erythema and Urticaria in next chapter p. 359, 360.) Other cases, especially when hereditary, are due to the gouty or lithaemic state and require appropriate diet.

In **Croup,** and, to a less degree in other respiratory conditions, the use of nauseating expectorants often interferes with digestion or even with the retention of food on the stomach.

Any condition marked by excessive cough tends to produce gagging and vomiting. So, too, the mere presence of mucus may disgust the patient and interfere with nutrition. Individual tact and attention to aesthetics may ameliorate these interferences with nutrition.

The entrance of food into the respiratory passages may cause immediate asphyxia or some degree of local inflammation which is not usually noticeable unless as inspiration pneumonia. The principal conditions dangerous in these ways are: anaesthesia, paralysis due to central lesions as in bulbar paralysis, neuritis as after diphtheria etc., general paralysis of the insane, debility as in

young infants, the aged, persons confined to bed after surgical operations, when drowning in the vomit may occur, paroxysmal cough, especially with marked inspiratory reflex, as in pertussis, greedy habits of eating and drinking.

In **Tubercular** and, to some degree in other forms of ulcerative laryngitis, nutrition is interfered with by painful deglutition so that painting or spraying with local anaesthetic solutions may be required preliminary to meals. If possible, this should be avoided by administering bland, soft diet, free from condiments. Gavage may be employed but is usually more distressing than voluntary swallowing.

Severe ulcerative lesions of the pharynx should be dieted as for diphtheria.

Pneumococcic disease has been discussed separately. About the same diet is indicated in other forms of acute pneumonia, bronchitis, pleurisy etc., bearing in mind that plastic exudates demand an abundance of water and salines whereas liquid exudates demand easily digested but comparatively solid food.

Chronic bronchial and pneumonic conditions require diet corresponding to that for consumption or cardio-vascular disease, according to the nature of the case.

In **pleurisy, hydro-, pyo-, and pneumo-thorax, vesicular emphysema** and other conditions in which respiration is mechanically embarrassed, particular care should be taken to avoid overdistention of the stomach and bowels, either with liquid, solids or gas. Hence excessive ingestion, ingestion of effervescing drinks, and of readily fermentable foods should be avoided. The dietetic and medicinal attention to excessive germ activity in the alimentary canal is also important.

Pulmonary Oedema is often a terminal process or, if not, so acute in its manifestations as rather to preclude the attempt at feeding. Hot saline injections into the bowel are indicated. If nutrition is necessary and feasible, hot, easily digested food should be used, as the proprietary milk foods, beef extracts, predigested milk, poached eggs on toast with paw paw extract as a digestant, egg nog made with predigested milk. As this condition is essentially a secondary process, due to renal and cardiac failure, it is

to some degree preventable by appropriate diet as considered under such headings.

Pulmonary Haemorrhage should be treated on the same general lines as gastric haemorrhages except that food and drink are not locally dangerous. Tea and coffee, very hot drinks, alcoholics etc., are contraindicated by their influence on circulation. The diet should be plain and easily digested, predigested if necessary, and the greatest pains should be taken to avoid overdistention of the stomach. Hence, feeding need be interrupted only during the period of active bleeding and the diet should then be that appropriate for convalescence from gastric ulcer.

CHAPTER XLIII.

DIET IN SKIN DISEASES.

The systematic consideration of skin diseases from the dietetic standpoint—or indeed from any other general standpoint of etiology and pathology or treatment—is rendered difficult partly by the fact that the nomenclature does not consistently follow either etiology, morbid anatomy or superficial appearances, but all three, so that the same term may include processes of very different nature while essentially the same pathogenic disturbance may receive different terms according to the exact form of lesion produced. Moreover, the matter has never been thoroughly studied by experts in both lines.

As a general principle, any chronic skin lesion not due to systemic or local infection, including infection with animal parasites, or due to obvious toxic, mechanic or thermic cause, is probably a manifestation of some general chemic disturbance. This may be directly due to toxins introduced with or forming a constituent part of food (and here many acute skin lesions may be included), or the disturbance may be of a general metabolic nature but due ultimately to insufficient or excessive food or drink or to secondary introduction of fermentative products on account of digestive faults, and hence more or less amenable to dietetic prophylaxis and treatment.

Erythema and **urticaria** are really different grades of the same process and are frequently caused by idiosyncratic reactions to various extrinsic causes, including foods. Why such a cause should have a toxic action on one person and not another is not explained. That it is not simply due to differences of susceptibility to definite toxic agents, is probable from the very minute quantities that cause symptoms in some individuals and the very large quantities that may be taken with impunity by the great

majority of individuals. The foods most frequently causing erythema or urticaria are shell fish of any kind, crustacea rather than molluscs, and strawberries. Fish, pork, mushrooms, cheese and other fruits than strawberries come next in general order of frequency and, as a rule, ordinary meats and vegetables, rarely produce these conditions. Preserved foods and especially such mixtures as hash, mince meat etc., are rather apt to produce these conditions, probably on account of toxins due to putrefaction. The only special dietetic treatment is avoidance of the cause, when established by individual experience.

Acne is especially liable to occur at puberty, doubtless partly on account of the general susceptibility of the organism at this time, but also on account of the tendency to nutritive disorders and dietetic errors. Buckwheat and to a less degree, oatmeal, are especially liable to cause acne; otherwise it is due, so far as dietetic causes are concerned, to foods rich in fat and, to a less degree, those rich in sugar whether naturally or by processes of preparation and cooking. Thus, doughnuts, fried foods, sausage, cheese, excess of cream, pastry, nuts, candy are especially likely to be incriminated. However, the standard ration of proper fatty, starchy and saccharine foods must usually be maintained.

In addition to avoiding the special causes of acne, it is usually necessary, even when the acne is chronic and not directly traceable to dietetic errors, to regulate the diet so as to conform pretty closely to the physiologic standard, and with regard to digestive and other disturbances, such as constipation, hypochlorhydria and many other functional and organic conditions.

Generally speaking, the best complexions and greatest freedom from skin diseases, are found in those who abstain from tea, coffee and alcoholic drinks, who use water freely but not excessively, who avoid rich, greasy and excessively sweet foods, and whose diet is well balanced and derived principally from cereals and fruits.

Eczema, and asthma are quite closely connected in heredity and pathogenesis with so-called lithaemic conditions, including gout. While excessive indulgence in sugar, starch or fat may precipitate attacks, the common cause seems to be excess of purins

and possibly also of proteid. Hence, the diet should be mainly vegetarian, not excessive. Free movements of the bowels and action of the kidneys should be maintained by the diet as discussed under Lithaemia. There even seems to be a "poor man's" eczema corresponding to "poor man's" gout and requiring a more abundant diet.

Eczema in nurslings is often due to dietetic errors on the part of the mother, which may or may not show in her own skin. Eczema in young children is, on the whole, more likely to be due to excesses in sugar, fats, and greasy foods, precocious tea, coffee and beer drinking, than to the typic meaty and purin-containing diet.

Various forms of **dermatitis, psoriasis** etc., are due to improper diet and are relieved by a diet consisting mainly of milk and cereals, with fruits not too rich in acid nor used in excessive amounts.

Rosacea, often classified with acne, consists of a telangiectasis and is due largely to alcoholism but also to excessive tea drinking, overeating and dietetic errors generally.

Furunculosis may be simply an intensification of acne and due to the same general causes, or it may indicate diabetes, tuberculosis, syphilis etc., for which proper dietetic regimen should be instituted, or it may be considered as a localized sepsis, due to inadequate or badly balanced dietaries so that the resistance of the body to septic germs is diminished.

Pruritus is commonly discussed as a neurosis but it is frequently due to lithaemia and the sudden, local occurrence of itching may even be taken to represent a direct deposit of urates in a nerve terminal. In many cases, it is associated with or actually due to vascular lesions, hepatic sclerosis, renal degeneration and other processes of a fibroid nature. While it is advisable to discontinue tobacco, alcohol, tea and coffee, condiments, and rich foods of various kinds, such direct dietetic methods are likely to fail. Particular care should be taken to avoid an exclusive milk or other inadequate diet, especially in winter, when the exposure to cold with lessened resistance may produce more serious results than the original trouble. Pruritus should be regarded as the symptomatic expression either of a general dyscrasia or of some

local disease interfering with metabolism, for example, incipient nephritis or hepatic sclerosis, and the diet should be regulated according to the underlying cause and not by any rule of thumb.

Stelwagon mentions, as dietetic causes of skin diseases:

1. Idiosyncrasy;

2. Direct local action about the lips, of acrid, acid and spicy and excessively hot or cold articles;

3. Nervous excitement or depression by tea, coffee, tobacco, alcohol etc.;

4. Irrational mixtures, as oatmeal or buckwheat with butter, syrup etc., acid fruits with milk or cream, or pickles with milk at same meal;

5. Overfeeding causes eczema, especially in infants;

6. Toxic changes in foods due to decomposition or to prolonged preservation without obvious decomposition;

7. Chemic food preservatives.

CHAPTER XLIV.

DISEASES OF THE NERVOUS SYSTEM.

The administration of nourishment is influenced by various general symptomatic nervous conditions, such as spasm, paralysis, pain, especially affecting the parts concerned in mastication and deglutition, and by disturbances of special sense, especially of taste and smell, and otherwise when disgust is caused. In acute conditions of short duration, the exacerbation of spasm and pain, the danger of asphyxia in paralytic cases etc., may contraindicate feeding. In chronic conditions, nutrition must be maintained, if necessary by recourse to the feeding tube, rectal injection, local anaesthesia etc. (See discussion of mumps, tetanus, laryngeal ulceration etc.)

Various hallucinations and delusions may indirectly interfere with nutrition. For instance, a tumor pressing on the olfactory bulb so as to cause the hallucination of a disgusting odor, visual hallucinations of an analogous nature, delusions of uncleanness, obsessions as that fasting is a religious duty, that the patient is under compulsion not to eat, delusions of persecution with fear of poisoning and various other false conceptions, may prevent the patient from taking needed food and drink.

Especially in melancholia, patients may obstinately refuse to eat and yet may submit to compulsion or may eat when fed by an attendant or may submit to or even voluntarily report for gavage.

Without any definite hallucinations or delusions or tendency to suicidal starvation, or apparent digestive disturbance, insane patients may fail to eat sufficiently on account of blunting of the senses of smell and taste, general lack of intelligence, or obtunding of the various reflexes upon which the cycle of individual muscular acts of ingestion depend.

Boulimia and coprophagia, both in the literal and extensive sense to include the eating and drinking of various disgusting substances are not infrequently noted in the insane. Boulimia may be due to a true though pathologic increase of appetite, to gastric dilatation, the sense of satiety being normally due to the stretching of the rugae of the stomach; or boulimia, like the reverse condition of hyporrhexia, may be due to lack of intelligence, the patient eating mechanically and not knowing enough to stop, or the patient may have in exaggerated form the prevalent lay notion that physical and mental strength may be increased by increasing the ingestion, especially of certain foods, thus boulimia may be a manifestation of delusions of grandeur.

Careful individual observation is necessary to insure that the insane patient takes a proper amount and variety of food and drink and it must not be forgotten that the same care is required to guard against or to detect the presence of actual disturbances and diseases of the alimentary organs, including the teeth.

Even with such care, the average advanced age and lack of physical and mental exercise, will render the average diet of the insane below that of healthy adults so that criticism of the management on the ground of too rigid oeconomy at the expense of the welfare of the patients will occasionally occur.

(NOTE. It is impracticable to discuss in detail, the dietetics of every nervous condition according to a systematic symptomatic classification. The attendant should bear in mind both the symptomatic name of the condition and its underlying degenerative, inflammatory or specific pathologic basis and apply the appropriate dietetic principles. Only such nervous conditions will be considered by name as present special relations between disease and food, in the direction of cause and effect or disease and treatment. Certain analogies, not mentioned will be readily understood.)

Neuritis. Among the causes may be mentioned gout, whose relations to diet is discussed under the latter heading, various exogenic poisons, such as lead, arsenic and alcohol and possibly tea, coffee and tobacco when used to excess. These causes, being diffused, naturally tend to produce multiple rather than local

neuritis and, according to some authorities, 70% of the cases of multiple neuritis are due to alcohol, though the neglect of proper nutrition and exposure to cold are often operative rather than the alcohol itself.

In the treatment of neuritis may be mentioned the value of deep injections of physiologic salt solution, in amounts of about 100 c.c. as stimulating local metabolism and facilitating the removal of toxins and thus conforming to the broad conception of dietetics. The diet itself is important and should be along the following lines: avoidance of alcoholics, tea, coffee, tobacco etc.; avoidance of purins, oxalates etc.; liberal use of water and salts; administration of an abundant, bland, easily digested diet, not entirely lacking in meat but without viscera and consisting mainly of cereals, legumes, milk, cream, butter and eggs.

Beri beri, an infectious polyneuritis, has been discussed elsewhere. (Chapter XLI.)

Neuralgia has been described as the cry of a starving nerve for food and it is supposed that there is a special call for phosphorus, both in the elemental form, as hypophosphites and phosphates, and in organic combination as lecithin.

While neuralgia is defined as a functional disturbance of the nerves, the term is undoubtedly often applied to a genuine neuritis, especially when the same nerve is chronically affected. In other cases, there is a distinct rheumatic or gouty condition, demanding appropriate diet.

Pacchymeningitis Haemorrhagica is especially common in drunkards. Other forms of meningitis are infectious, due to vascular lesions etc., and are to be treated according to the corresponding dietetic principles, usually as fevers in general, with special regard for paralysis, spasm etc., as already discussed.

Spinal Cord Diseases in general require the diet appropriate for fevers, degenerational diseases and those with enforced lack of exercise, jointly or respectively. Any food stuff likely to cause irritation of the urinary passages should be avoided and ordinary fruits and alkalies on the one hand, benzoic-acid containing fruits and vegetables on the other, should be used to prevent or counteract departures from the normal moderate urinary acidity, there

being more often an indication for the latter, on account of the tendency to ammoniacal decomposition. (See discussion of urinary organs.)

Owing to the frequency of lack of control of the bowels, the diet should be regulated so as to prevent excessive decomposition by micro-organisms within the alimentary canal and so as to avoid diarrhoea or constipation. There should be one formed but not scybalous passage a day unless there is, on the one hand, an indication for a derivative effect through the bowels or, on the other, some special objection (for instance a fracture of a vertebra) to moving the patient except as absolutely unavoidable. In the former case, an abundance of water, fresh fruits and salines should be used, in the latter, the diet should be relatively dry and as free as possible from indigestible residue, for example eggs, peptonized milk, fine cereals, artificial milk foods etc.

Great caution should be observed in using excessive quantities of fats or sugars, or cellulose, including seeds, chaff and other dense vegetable tissues as in the fruits and coarse vegetables. It is far better to employ purpetrol, cascara and other laxative drugs.

Glosso-Labio-Lingual Paralysis involves motor function almost entirely. While the muscles of mastication, ordinarily so considered, are not involved, unless as a complication, the adjustment of the food between the teeth is interfered with by the paralysis of the buccal and lingual muscles so that mastication is imperfectly performed. The loss of saliva by drooling diminishes the preliminary digestion of starch—although this function is not ordinarily of much importance—as well as the reflex stimulation of gastric secretion. Deglutition is difficult and there is constant danger of inspiration pneumonia or even asphyxia from the entrance of food and drink into the respiratory passages. Thus, careful cutting, mashing and scraping of food, assistance in feeding and even the use of gavage may be required.

Cerebral Hyperaemia or Ischaemia may be determined by various circulatory disturbances, organic and functional and it is not always easy to distinguish these extremes by the symptoms. For well known histologic reasons, the arterioles of the brain are less amenable to regulation of calibre than those of the body gen-

erally so that factors which produce constriction of arterioles generally produce cerebral hyperaemia and vice versa.

Caffeine, theobromine and xanthin and its congeners, derived respectively, from tea and coffee, chocolate and purin-containing foods, have a general tendency to produce cerebral hyperaemia, stimulation of function and wakefulness.

On the coutrary, it has been pretty definitely proved by measurement of the time of response to sensory stimuli, ergograph tests etc., that alcohol never genuinely stimulates the brain, in spite of the fact that the person who has imbibed thinks that he can act more quickly and think more brilliantly. However, there is reason to believe that, in spite of the dilated condition of the surface vessels, the compensatory quickening of the heart really produces a form of cerebral hyperaemia, so that small doses of alcohol may cause sleeplessness. It must also be remembered that, for mental and physical activity not requiring great accuracy or effort, the subjective feeling of stimulation, removal of inhibitory dread and inertia, does enable the individual to perform tasks that would be impossible without it.

What has been said of alcohol applies, to a less degree, to tobacco.

In emergencies in which wakefulness and mental activity are necessary, coffee is the remedy par excellence, closely followed by tea and chocolate, beef tea, and strychnine. Hot drinks, without reference to their active agents, by promoting the rapid absorption of liquid, fill the blood vessels and hence cause some degree of cerebral hyperaemia. It is scarcely necessary to caution against the unnecessary use of such stimulants nor to point out the need of securing compensatory rest as soon as possible. Their habitual use is disastrous though a considerable degree of tolerance is acquired.

A patient suffering with insomnia due to cerebral hyperaemia should take no stimulating beverage of any kind during the latter part of the day and the evening meal, especially, should be light and easily digested, even large quantities of water being deleterious on account of their tendency to produce vascular fullness. On the other hand, a light meal, as of bread and milk, egg on toast, or a

few crackers with weak cocoa, may, by determining the blood to the stomach and, ultimately, the intestine, relieve the cerebral hyperaemia and induce sleep.

Cerebral ischaemia, with tendency toward syncope and hebetude is usually noted in severe grades of anaemia, in heart disease and in wasting diseases generally. The diet should be regulated accordingly.

Alternations of hyperaemia and ischaemia are especially likely to occur in functional vascular diseases and organic valvular heart lesions. Perhaps the most serious illustration is that of aortic regurgitation. With the head erect, the brain is, in the main anaemic and the patient often complains of drowsiness. But, in the recumbent posture, there is rather a cerebral hyperaemia and wakefulness ensues. While such patients require careful dietetic management along the lines mentioned, it can not succeed in overcoming the effect of the water-hammer pulse.

Apoplexy, either in the sense of arrest of circulation by thrombosis, embolism etc., or in the more common sense of cerebral haemorrhage, depends upon the general causes of cardio-vascular disease, among which diet has been mentioned as playing an important and, to a considerable degree an avoidable part.

After the rupture of a cerebral vessel, there is a general indication to secure a derivation of blood to the alimentary canal by catharsis, croton oil being preferred on account of its rapid and irritating action. While, to a certain degree, food fulfills this indication, it also tends to fill the vessels and stimulate the cardiac action so that a fast, with as little liquid as possible, should be instituted for two or three days.

The exciting cause of apoplexy, either in the limited or broad sense, is very frequently a dietetic indiscretion. Overloading the stomach, distention of the stomach and intestine with gas from effervescent beverages or from fermentation, tend directly to increase intra-abdominal and intrathoracic tension and hence blood pressure. Either very hot or very cold ingesta may disturb the vascular tension and, whether the direct effect is to reduce or increase vascular tension, the oscillation may be the exciting cause of the formation of a thrombus, the dislodgement of a vegetation which

becomes an embolus, or the rupture of a degenerated vessel. Coffee and tea and, more gradually, purin containing foods, act directly to raise arterial tension. Alcohol, while theoretically reducing arterial tension generally so as to lessen the amount of blood in the brain, may produce apoplexy either in the rebound or because of the antagonistic influence of a quickened heart beat or by a reflex rise from the psychic stimulation or from some effort to which the incipient intoxication leads.

The prophylaxis of apoplexy, from the dietetic standpoint is included in the general discussion of vascular and cardiac diseases. The patient should be warned, if necessary to his control, that there is scarcely any kind of dietetic error that may not lead to apoplexy, the "stroke" occurring with relative frequency at or shortly after a hearty meal.

Paralytic conditions in general, whether due to apoplexy or other condition, usually indicate a fast for several days after their inception. The after treatment includes an easily assimilated, nutritious but rather low diet as for elderly persons unable to take much exercise. (See discussion of diet in the aged, in cardio-vascular disease etc.)

The generally accepted indication for iodids may be fulfilled by iodothyrin, unless there is a concomitant exaltation of thyroid function when it is, at least, doubtful whether iodids should be given in any form.

The theoretic indication, often present, to raise blood pressure by hot drinks, caffeine-containing beverages, suprarenal extract etc., is relatively opposed by the danger of exciting fresh haemorrhage in paralysis due to this cause and adrenalin is probably especially contraindicated by its action in hastening vascular degeneration. However, it should be observed that the experiments establishing this action have imposed exaggerated conditions which may not be duplicated in the ordinary use of adrenalin. Due attention should be paid to possible complications in the heart, vessels, kidneys, liver, pancreas etc. The bowels and bladder may require dietetic management for the reasons mentioned under lesions of the spinal cord.

Chorea is often of rheumatic origin; indeed there is a tendency to regard rheumatism as the sole etiology of genuine chorea, as distinguished from other forms of tremor. At any rate, the diet should be as for rheumatism, with such modifications as the age of the patient, anaemia, the existence of pregnancy etc., may suggest.

Epilepsy is very frequently marked by indicanuria and other manifestations of alimentary sepsis and the frequency of the attacks can usually be much diminished solely by dietetic and other treatment directed toward the alimentary canal. Conversely, the treatment of epilepsey by bromids and borax etc., often depresses the digestive secretions, induces indigestion and consequent fermentation and putrefaction which are not only evils in and of themselves but which tend to precipitate epileptic seizures.

Aside from these considerations, epilepsy requires the avoidance of tea, coffee, alcoholics, decomposed or readily decomposable food, viscera rich in purins, and in fact of any food or drink which of itself, or in the process of digestion and catabolism, introduces any notable amount of any kind of toxic agent or which is capable of producing reflex disturbance by its bulk, temperature etc.

It should be remembered that epileptiform convulsions may be due to delirium tremens, uraemia and various other forms of toxaemia. It is held by many that epileptiform convulsions in children due to intestinal parasites, intestinal putrefaction etc., may lead to genuine epilepsy. Various forms of epileptiform convulsions may be indirectly due to dietetic errors and, on the other hand, somewhat amenable to dietetic treatment.

The routine dietetic management of the child, as previously discussed, thus has an important bearing on the development of epilepsy, chorea, hysteria etc.

Tetany, while often due to more or less frank disease or disturbance of the thyroid or the parathyroids, is in many instances, directly symptomatic of gastro-intestinal irritation, notably in gastric dilatation in children. It is by no means impossible that many cases diagnosed as cerebro-spinal meningitis, especially when recovery ensues, are of this nature.

Tetany has occasionally been observed to follow lavage instituted in the treatment of gastric dilatation and stagnation. While the introduction of the tube may be the exciting cause of the spasms and while the water used may facilitate the absorption of toxins beyond the reach of the tube, in the intestine, efficient treatment of the underlying cause is not to be abandoned.

Careful dietetic management of the underlying digestive disturbance, is both prophylactic and curative. If the indications are not too urgent, it is well to reduce the diet to water, bouillon and weak beverages for a few days and to clear out the bowels, before practicing lavage in cases in which tetany is to be anticipated.

Hysteria may, for therapeutic purposes, be divided into three groups: 1. those due to frank or disguised "cussedness"; 2. those due to grief, excessive fatigue, worry etc.; 3. toxaemic cases.

Cases of the first group may manifest various dietetic vagaries, including abstention from one, several or all foods, sometimes ascribed to religious influences. It is often exceedingly difficult to draw the line between genuine idiosyncrasy and hysteric aversions or alleged evil effects from food. While it is not worth while to try to dispel every false notion regarding food, any serious interference with nutrition or even the convenience of the family of the patient, should be met with moral suasion, more or less compulsory feeding or even gavage.

Cases of the second group also often require moral suasion, but in a somewhat different spirit, to induce the ingestion of sufficient nourishment. The services of an efficient diet nurse in preparing dishes that appeal both to the eye and the palate, are especially valuable. Even without manifestations of hysteria, persons recently bereaved or subjected to worry and fatigue, or leading a monotonous life, and eating alone or in small families, often lose appetite. A change of scene or even the advent of a guest or a change of methods of cooking, may suffice to restore nutrition.

Toxaemic conditions, however manifested, do not warrant the diagnosis of hysteria any more than disturbances of mentality due to atropine, alcohol and other drugs. In some cases, the so-

called hysteria is amost purely intestinal, due to fermenting and putrefying food. In others there is hepatic sclerosis, chronic Bright's disease etc. Especially in women, pelvic reflexes or more or less obscure thyroid disturbances are common at the menopause. The appropriate diet is discussed under these and analogous headings.

Neurasthenia borders on hysteria of the second type. While there may be no indication for special dietetic precautions and while boulimia may be observed, there is usually loss of appetite and the patient requires rest and change of scene, and diet.

The S. Weir Mitchell rest and diet cure is indicated in severe cases. The patient is isolated from family and friends and put to bed in a quiet room under the care of a nurse. In addition to baths and massage, the diet is restricted. At first, milk alone is given every two hours, day and night, unless the nocturnal feeding interrupts the sleep too much, when two four-hour intervals are allowed. If the patient manifests an antipathy to milk, only a tablespoonful is given at a time at first, otherwise it is increased as rapidly as possible up to 300 c.c. at each feeding. (NOTE. The author, for reasons stated elsewhere, would never feed so frequently nor give so much as 3600 c.c. of milk in the 24 hours.)

If necessary, the milk may be flavored with coffee or cocoa, caramel etc., and lime water, Vichy, barley or rice water, may be added if pure milk causes eructations or epigastric oppression.

The milk diet causes drowsiness, favors rest and not only produces a minimum of toxins but by diuresis, favors elimination of those in the system, with the assistance of massage.

After five or six days, a chop or poached egg may be given in the middle of the day; the next day, bread and butter or bread and milk is added for supper; on the third day egg, meat or bread stuff is added for breakfast. The milk is correspondingly reduced until, within a week, the patient is taking 2 quarts of milk and a light solid diet daily.

It should be carefully considered in any case, whether the patient will be more benefited by a month or two of this vegetative existence or by rest and recreation in the open air—not at a fash-

ionable resort—with an abundance of plain food. But the need of the absolute rest cure must be recognized in certain cases.

Heat stroke requires no feeding for a day or two and, owing to the exhaustion of nervous energy, neither hot nor cold drinks should be allowed. Hot or cold saline solution, according to the indication, may be given by the bowel.

Delirium Tremens, while ultimately due to alcoholism is not alcoholic intoxication but a toxaemia due to various metabolic substances whose nature is not well known and which are probably not the same in all cases. Probably certain cases are essentially uraemic, others cholaemic, others due to intestinal putrefaction and others due to more recondite intoxication. So far is delirium tremens from being an alcoholic intoxication that it may be prevented, when imminent, by continuance of alcohol and its treatment is considered by most authorities to demand a moderate use.

The possibility of delirium tremens should be borne in mind in surgical accidents, typhoid fever, pneumonia and other diseases, occurring in chronic alcoholics, and too sudden interruption of the alcoholic habit should be avoided, although it should always be indulged in moderation.

Water, fruit juices, saline enemata etc., are usually indicated to aid purgation and diuresis and hot catnip and other teas may be employed as sudorifics.

The diet should be as liberal and as unirritating as possible and predigestion or artificial digestants should be employed if necessary. On the whole, the best diet is one of milk, eggs, eggnog, peptonized milk, expressed beef juice, junket, wine whey, brandy and egg etc., with moderate use of cereals. While care should be taken not to overload the system with products of proteid and purin metabolism or intestinal putrefaction, meat and even tea and coffee are often indicated for their stimulating effect.

CHAPTER XLV.

SURGICAL EMERGENCIES AND OPERATIONS.

In any critical surgical case, expert medical and dietetic management is just as necessary as expert surgical skill and, on the average, there is the same likelihood that the surgical specialist can satisfactorily discharge the former duties as that the internist can perform a difficult, technical operation.

Healthy persons, sustaining a fracture, a non-septic wound or other accident, not involving a high degree of shock and not affecting the viscera, or undergoing a corrective, non-emergent operation with absence of the two factors just mentioned, require no particular dietetic management, but allowance should be made for change of habits with regard to exercise etc., and there is frequently a demand for laxative diet.

A general anaesthetic should not be given when the stomach contains food or any considerable quantity of liquid. Even if no anaesthetic is given, the pain and shock of operation will probably reflexly inhibit digestion, so that it is better to operate with the stomach empty, although coffee or even an alcoholic may be employed as a stimulant. Under such circumstances, provided that there is no inherent cardiac weakness, alcohol is usually satisfactory, since the main necessity is for psychic stimulation. Indeed, if sufficient alcohol is given, genuine anaesthesia results, there being no essential difference between the effect of ethyl oxid (ether) inhaled, or absorbed from the rectum, and of ethyl hydroxid (alcohol) taken by mouth.

In preparing for anaesthesia, allowance must be made for abnormally slow gastric motility which may, indeed, be due to the reflex inhibition of dread and pain. Thus, while theoretically a patient to be operated on at eleven, might take coffee and roll, or bread and milk, or beef broth and crackers, or some similar light

meal, at seven, it is unwise to run any chance of asphyxia from vomiting during anaesthesia. In non-emergent operations, it is far better to give the last meal in the evening and to operate rather early in the morning, before hunger and thirst are felt. In emergency cases in which the stomach contains food or liquid, emesis should be produced, the tube being usually inadequate to remove solid food.

In the after care of the class of surgical cases under discussion, no special dietary is necessary but the following points should be remembered:

1. The patient—excepting for the ambulant treatment of fractures, dislocations and comparatively slight wounds, not interfering with locomotion—needs only the ration of a sedentary or recumbent individual.

2. Pulpy laxative fruits and vegetables are usually indicated to combat the tendency to constipation.

3. Processes of repair theoretically require a relative excess of proteid, though not more than is contained in the ordinary, unrestricted diet, and meat and blood extracts are indicated if there has been much haemorrhage; fresh vegetable foods for their content of lime, after fractures; gelatin if there is a tendency to renewed haemorrhage; alcohol to prevent delirium tremens if the patient has been accustomed to considerable use of such beverages; per contra, in conditions involving nervous shock, as head injuries and falls, an excess of carbohydrates might perhaps better be avoided, though the danger of the glycosuria to which such injuries predispose is not very obvious; in fractures, especially, if lipuria appears, and in the obese, fats should be reduced to the minimum.

4. Owing to the general reduction of vitality, all foods should be as simple and digestible as possible, without suggesting to the patient that he is on a sick man's diet.

A second group of surgical cases includes those in which the vigor of the patient has been undermined, either by the patho-

logic process for which the operation is undertaken—for example pyosalpinx, pyothorax, tuberculous peritonitis—or by surgical shock incident to the injury or to the operation itself, as in cranial operations, resection of a kidney, operations involving much haemorrhage and delay—but in which there is no marked local digestive lesion and, particularly, no traumatic or operative solution of continuity of the alimentary canal.

In such cases, feeding by mouth can usually be resumed as soon as the nausea due to the anaesthetic has passed off, or, at most, after a delay of 24 hours. On the one hand, sepsis is favored by lack of nourishment, on the other by saprophytosis in the intestine. Even if the patient is obese or gouty, this is no time for starvation treatment. Intestinal atony and spasm, either of which occasionally follows operation, seems to be prevented to some degree by the presence of alimentary contents. The most appropriate diet is that for early convalescence from fevers—milk, eggs, singly or variously combined, toasted bread and crackers, beef juice and extracts, jellies etc., using alcohol, tea and coffee, according to special indications and peptonizing or making use of rectal or hypodermatic nutrition if necessary.

The third group of surgical cases consists of those in which the primary lesion, pathologic or traumatic, or the secondary, essential or accidental surgical lesion, or both, involve the alimentary canal itself. For practical purposes, we must also include in this group, various biliary, hepatic, pancreatic and intraperitoneal operations, in which the diet has a very direct and marked influence on the immediate result.

As a general rule, cases of this nature should not be fed by mouth, or through a fistula established at the time of the operation, for at least 24 hours. While a considerable degree of plastic union may be expected at the expiration of this interval, it is wise not to test its strength for at least two or three days or, in the case of extensive resections, anastomoses etc., for a week, unless the indication for nutrition is urgent, as in gastrostomy deferred until starvation is imminent, after oesophageal closure.

If the lesion involves the large intestine, even including the appendix, the same rule should be applied to enemata for, although

the injection is not directly deposited near the upper part of the colon, reflex peristalsis may carry it there or the entrance of fluid into the rectum may indirectly distend the upper colon or excite peristaltic waves. However, in the case of a small solution of continuity, as after a simple removal of the appendix, two or three days' delay is almost always sufficient and feeding by mouth may them be resumed. Even before this time, small quantities of beef juice, or innutritious beef tea, peptonized milk etc., which yield very little residue, may be given in most cases.

In operations on the salivary glands and ducts, it is desirable to feed by the bowel and by hypodermatic injection and inunction for several days. Thirst and hunger may be repressed by opiates and care should be taken not to stimulate the secretion of saliva by sapid medicine allowing the patient to see food or smell it in process of cooking etc. Even with such precautions, fistulae are liable to occur.

In oesophageal operations, it is frequently possible to introduce a tube so that feeding may be resumed almost immediately, without irritation of the wound. Otherwise, the general principles discussed should be followed, so as to allow a considerable time for healing.

Operations on the stomach and upper intestine, are directly amenable to the general principles applying to this group of cases.

After all operations requiring anaesthesia and in which the dorsal posture is to be maintained for some time, and the patient is unconscious or helpless, care should be taken that the patient does not drown in his own vomit or aspirate even small masses of mucus or food into the air passages. Vomiting is especially frequent in biliary lesions, perhaps most of all in cases of gall stones, but also frequently occurs when there is peritonitis or mechanic pinching of the peritoneum-covered viscera, such as the bowel, and when the female pelvic organs are involved. An important detail is the selection of a nurse vigilant and strong enough to handle a patient quickly in such an emergency.

When, for any reason, any considerable wound has been made through the abdominal wall, very much the same precautions must be taken against undue distention of the alimentary canal,

increase of abdominal pressure by vomiting, retching, gagging, straining etc., as if there were a lesion of the alimentary canal itself. Indeed, the abdominal wall bears almost exactly the same relation to the alimentary canal as does the outer case of a double pneumatic tire to the inner tube. Aside from the danger of tearing out stitches—sepsis, haemorrhage, failure of primary union—such strains upon the abdominal wound must be avoided until firm cicatrization has occurred, and for this process, several months must be allowed.

In operations directly involving the rectum and the lower bowel generally, the diet should preferably be rather light and easily digested, so as to yield little residue for several days before the operation. The bowels should be thoroughly emptied, both by cathartic and enemata, the evening and the morning before the operation. Further passages should be avoided, if possible, for three or four days although it must be admitted that if sutures and ligatures are properly applied, earlier passages do not usually do mechanic injury and sepsis can be avoided by douching with physiologic salt solution or mild antiseptics. While the bowels may be locked up with opium, it is more rational to withhold nourishment for 24 hours and to give very light, digestible or predigested nourishment which yields little residue, for two or three days more, so that the first few passages are small.

As has been stated, operations involving direct lesion of the alimentary canal, its tributary ducts and its restraining wall, should generally have a post-operative period of 24 hours to a week —on the average, two to four days—in which no food or liquid enters the alimentary canal, hypodermatic injection and inunction being employed if necessary, though the rectum may also be used if the lesion is above the large intestine. Following this period, is a variable one of very light, digestible, practically residue-free diet and then one of more liberal but carefully selected diet before the patient is discharged by the dietetist.

The management of this third period is practically independent of the direct operative lesion and, obviously, too, of the lesion for which operation was undertaken, providing that the operation has been radically successful. This is merely another way of stat-

ing the fact that perfect union of the wound in the alimentary tube itself, is to be expected within a short time, say ten days to three weeks at the utmost. The qualification must be made that an intentional or adventitious fistulous opening requires more protracted care and that the abdominal wound does not become firmly cicatrized for several months.

The principles governing fistulae of the alimentary canal itself—gastrostomy, enterostomy, gastro-enterostomy etc.,—are largely due to interferences with the normal passage of contents and are discussed elsewhere.

Fistulae involving the conduction of the secretions of the tributary glands, salivary, hepatic and pancreatic, all demand for their closure the highest practicable degree of suppression of secretion during the process of healing. Salivary fistulae are practically always adventitious. While the secretion has a physiologic function in connection with digestion, it is not very important for reasons already discussed, and as it acts only on cooked starch, it has no corrosive action. Thus the fistula is objectionable rather on cosmetic grounds than physiologic.

Hepatic and biliary fistulae are usually intentional for the practical reason that drainage is more easily and more safely provided thus than by attempts at immediate discharge into the intestine. The hepatic secretion is not of great importance physiologically, the main function of bile being eliminative. Still, the permanent or prolonged drainage of so much water and alkali and of the biliary salts is physiologically detrimental. It is also inconvenient and mortifying to the patient. The fistula seems to have no more corrosive action on the skin than the discharge of so much saline solution.

Jaboulet, Tixier and von Chappert have called attention to the fact that the leakage from biliary fistulae is most troublesome late after meals. In their report, two cases are mentioned in which the flow began quite regularly 5½ hours after meals. By giving a late evening meal, they succeeded in diverting the bile into the intestine and thus securing healing of the fistula. This method has been corroborated by other observers.

Pancreatic fistulae are not so common as biliary and are almost always either purely accidental or due to the impracticability of treating an abscess, cyst, tumor or calculus, or a direct traumatism, by immediate closure of the external wound and normal drainage into the intestine. The pancreatic secretion is of immense practical physiologic importance and, owing to its digestive action on fat and proteids, a pancreatic fistula or one into the upper intestine, is always highly corrosive and it is exceedingly difficult to protect the tissues by water-tight dressings. Sufficient operative and experimental experience has not been accumulated to establish rules for feeding to expedite the healing of pancreatic fistulae but they are undoubtedly to be treated dietetically on the same general lines as biliary.

Without entering into a protracted discussion of the dietetic management of surgical cases involving the alimentary canal, its sustaining wall and tributary glands, for the third period of more liberal but still carefully guarded diet, the following general principles may be stated: complicating diseases and such organic or functional digestive disorders as remain after operation, should receive due attention; the diet should be regulated with regard to the existence of fistulae, adhesion threatening obstruction, and other organic results of the operation; while the first period of starvation and the second period of limited, residue-free diet suffice for the healing of the direct lesion of the alimentary tube, and the obliteration of blood vessels that have been cut, the abdominal wound or any similar mechanically weak resulting lesion, requires the avoidance of all forms of strain for many months. Saprophytosis, with formation of gases; constipation, with subsequent increase of peristalsis and of intra-tubal pressure; straining at stool, retching, vomiting etc., must be avoided.

APPENDIX.

SOUPS.

Turkish Soup.

1 quart of stock, yolks of 2 eggs, $\frac{1}{2}$ teacup of rice, 1 tablespoon cream; salt and pepper.

Boil the rice and stock together for 20 minutes; then press through a seive, and return to the kettle. Beat the egg yolks well, and add the cream to them. Add this to the stock and rice, and stir for two minutes over the fire, but do not let it boil. Season with salt and pepper and serve.

Veal or Chicken with Sago.

$1\frac{1}{4}$ lbs. veal or chicken, $\frac{1}{8}$ lb. of sago, $\frac{1}{2}$ pt. milk, 2 eggs, 3 pts. water.

Boil the meat chopped fine, till the water is reduced to about half the quantity. Strain out the meat, and put the soup over the fire again. Have the sago washed, and soaked for half an hour in warm water enough to cover it. Stir into the soup, and boil for half an hour, stirring it often to prevent scorching. Heat the milk nearly to boiling, beat the eggs very light and stir gradually into the hot milk, and pour into the soup, stirring all the time. If too thick add hot water, till it is about like hot custard. To secure the proteid of the meat, add also the shredded meat.

Chicken and Clam Bouillon

Mix 1 qt. chicken stock with 1 qt. of clam juice, heat to boiling point, and season with salt, pepper, and cayenne. Serve in cups with whipped cream.

Oyster Stew.

Put a quart of oysters on in their own liquor. As soon as they begin to boil, skim them out, and add to the liquor after skimming it well, $\frac{1}{2}$ pt. of hot cream, and salt and cayenne pepper to taste. Lastly add the oysters with an ounce and a half of butter, and serve at once.

Beef or Chicken Tea.

Cut in very small pieces freed from fat. Put into a stout jar with no water, and immerse it in a kettle of water, which may then be boiled for several hours, giving as a result, the juices and extractives only of the meat. By simmering at a temperature of about 130, considerable proteid may be extracted.

Macaroni Soup.

1 qt. of boiling stock to which may be added 2 tablespoonfuls of boiled mararoni. Salt and pepper to taste.

Barley Broth.

To 3 pints of stock, add 5 tablespoonfuls of pearl barley, which has been washed, and soaked an hour. Flavor with herbs and an onion if allowed. Add salt and pepper.

Mutton Broth.

Lean mutton with the bones, about 3 lbs., clear it of all fat if possible, 4 tablespoonfuls of rice, 1 of salt. Boil all together slowly, skimming if necessary. Take out the bones when done, clear it of all fat, and serve hot.

Nicer if cooked long enough before hand to cool so as to take all the fat off at once; and then heated to serve.

Beef Tea with Oatmeal.

Wet two tablespoonfuls of oatmeal with cold water, and add it to a pint of beef tea while boiling. Cook slowly till the meal is done, and strain and serve hot. Flavor with salt and pepper. Other cereals may be substituted.

Wafers.

1 quart of sifted flour, 2 tablespoonfuls of butter, and a little salt. Mix with sweet milk to a stiff dough, roll out very thin, cut into round cakes, and roll these as thin as possible. Lay them in a pan well floured, and bake very quickly. Very delicate.

Pop Overs.

2 eggs, ½ pt. milk, ½ pt. flour, ¼ teaspoonful salt. Beat the eggs well, add the milk and salt. Put the flour into a bowl, add the eggs and milk, stirring all the while. Bake in popover cups or gem pans, buttered and heated, fill half full, and bake in hot oven about ½ an hour. They should rise to four times their first bulk. Good at breakfast, or for dessert with a sauce.

Baked Macaroni.

Break 1 cupful of macaroni into small pieces, boil in water rapidly for twenty minutes, drain, and place in cold water for a few minutes, melt two tablespoonfuls of butter in a sauce pan, add two tablespoonfuls of flour, and 1 pt. of milk, stirring all the time. Put the macaroni in a baking dish, sprinkle with salt and pepper, pour over it the dressing. Cover with bread crumbs, and butter and bake.

Potato Puffs.

Take 1 cupful of cold mashed potato, stir into it 1 tablespoonful of melted butter and beat to a cream. Beat 1 egg very light and add to the potato with ½ cup of cream or milk, and salt to taste. When all well beaten, put in a deep dish, or in cups, and bake till brown.

Broiled Potatoes.

Slice lengthwise cold boiled potatoes, either Irish or sweet, and broil on a toasting iron over a hot fire. Salt and butter them, and serve hot.

Potato Roll.

Put 1 cup of cold mashed potato into a bowl, add 2 tablespoonfuls of cream, ½ teaspoonful of salt, mix well and add 3 well beaten eggs. Heat 1 tablespoon of butter in a frying pan, put in the potatoes spread evenly. Cook till they are brown, turn one half over the other, and serve hot.

Sweet potatoes can be used in the same way.

Raw Meat Balls.

Scrape raw steak with a sharp knife, removing first all fat and tendon. Flavor with salt and pepper, and a little of allspice if liked.

Make into little balls and roll round in a hot frying pan, just to cook the outside a trifle.

Sandwiches.

Scraped meat spread on very thin bread and butter is readily eaten.

Raw Meat and Crackers.

Toast soda crackers, butter slightly and spread with scraped meat. Heat for 2 minutes, and serve.

Steak.

The tenderloin, cleared of fat, broiled over a hot fire, seasoned with salt, pepper and a little butter.

Chops.

Cooked as above till well done.

Frizzled Beef.

1 cup of dried beef chipped fine, ½ tablespoonful of butter, ½ tablespoonful of flour, 4 tablespoonfuls of milk.

Freshen the beef in cold water, and drain. Melt the butter in a frying pan and stir till the butter begins to brown, dredge in the flour, and stir, then add the milk and a little pepper. Stir till it boils and serve, on toast if liked. A beaten egg is a welcome addition.

Fillets of Fish.

Take the sides of the fish from the bones, working them loose with a fork handle or knife. Trim neatly, and broil. Season with salt, pepper, and butter.

Creamed Salmon or Other Fish.

1 can of salmon minced fine, and all the liquor drained off.

For the sauce boil 1 pint of milk, 2 tablespoonfuls of butter, salt and pepper to suit. Take 1 pint of fine bread crumbs, place alternately a layer of crumbs and one of fish in a baking dish. Pour the dressing over each layer of fish, and finish with a layer of crumbs on top. Bake brown.

Creamed Oysters.

½ tablespoonful of butter, 1 heaping tablespoonful of flour, 1 cup of hot milk, 1 pint large oysters.

Melt the butter in a sauce-pan, stir gradually into the butter the flour. When cooked for a few minutes add slowly the milk, seasoned with salt and pepper, and 1 teaspoonful of celery salt. Wash the oysters, boil them in their own liquor till plump, drain them, and pour over them the hot sauce.

Roast Oysters on Toast.

Toast slices of bread. Wash and wipe large oysters, spread on the toast as many as possible, season with salt, pepper and plenty of butter. Bake in a hot oven until the oysters are done. Serve hot on the same dish on which they were cooked.

FISH SAUCES.

Drawn Butter.

4 tablespoonfuls of butter, 1 tablespoonful of flour, 1 cup of boiling water.

Rub butter and flour together, and stir into the boiling water, stirring steadily. Flavor with a little parsley.

Egg Sauce.

To the above add 3 hard boiled eggs chopped fine.

PUDDINGS.

Apple Pudding.

Fill a buttered baking dish with sliced apples, and pour over them a batter, made of 1 tablespoonful of butter, $\frac{1}{2}$ cup of sugar, 1 egg, $\frac{1}{2}$ cup of sweet milk, and 1 cup of flour with 1 teaspoonful of baking powder sifted in it. Bake in a moderate oven till brown and serve with cream and sugar or a liquid sauce. Very good with peaches or other fruits.

Steamed Berry Pudding.

$\frac{1}{2}$ cup of sugar, 1 cup of flour, $\frac{1}{2}$ cup of sweet milk, 1 cup of berries, 1 egg, 1 teaspoonful of baking powder.

Beat the egg very light, and stir all the ingredients together till smooth and light. Place in a buttered mould, and steam about 2 hours. Serve with either hard or liquid sauce as preferred.

Cottage Pudding.

1 cup of milk, $\frac{1}{2}$ cup of sugar, 1 egg, 2 tablespoonfuls of melted butter, 1 teaspoonful of baking powder, sifted with 1 pint of flour.

Beat very light, bake $\frac{1}{2}$ an hour, and serve with liquid sauce.

Very nice with fruit added.

Tapioca Pudding.

2 tablespoonfuls of tapioca, 1 pint of milk, $\frac{1}{2}$ cup of sugar, 2 eggs, and a little salt.

Soak the tapioca for several hours, washing it first. Beat the yolks of the eggs very light, stir in the sugar and salt, drain the tapioca, and mix all with the milk, and cook in a double boiler, stirring two or three times during a half an hour. Beat the whites to a stiff froth, add $\frac{1}{2}$ a tablespoonful of sugar. Place in the dish and dip the custard over it, when done, flavoring it first with vanilla, lemon, or other flavors, as liked. Very good either hot or cold.

Much liked when apples, peaches or bananas are added.

Rice with Apples.

Cook ½ cup of rice in 1 pt. of milk, add a piece of cinnamon, and a bit of lemon peel. When the rice is done, cool it, and make it into a border around a baking dish, and brush it all over with a beaten egg. Fill the middle of the dish with stewed apples, sweetened. Beat the whites of 4 eggs to a froth, add 4 tablespoonfuls of fine sugar, and beat till stiff again. Heap this over the apples, sprinkle with powdered sugar, and brown lightly in a quick oven.

Rice and Peach Pudding.

Cook ½ cup of rice in 1 pt. of milk till the milk is absorbed. Butter a mould, sprinkle it with bread crumbs, spread alternately a layer of rice and one of peaches, either fresh or canned, till the mould is full. When done turn from the mould, and serve hot, with custard or cream.

Sponge Cake Toasted.

Toast 2 inch square slices of stale sponge cake. Beat ½ a glass of apple jelly till light, then stir into it the well whipped whites of 2 eggs. Spread this on the toast, and place a canned cherry on each piece. Serve cold, with cream.

Baked Custard.

1 quart of milk, 4 well beaten eggs, 4 tablespoonfuls of sugar.

Flavor with lemon, vanilla or nutmeg, and a pinch of salt. Bake slowly, and do not let it cook long enough to whey.

Boiled Custard.

Make as above, but cook in a double boiler, till smooth. If it is cooked too long it will be grained, and the whey will settle.

Frozen Custard.

Heat 1 qt. of milk in a double boiler. Beat 4 eggs together with 1 cup of sugar. Stir this into the milk and cook 1 minute. Strain, cool, add 1 teaspoonful of vanilla and freeze.

Arrowroot.

Mix thoroughly 2 teaspoonfuls of arrowroot with 3 tablespoonfuls of cold water and pour on them ½ pint of boiling water stirring all the time. If the water is really boiling, it will be thick enough, if not, boil till it does thicken. Sweeten to taste, and flavor with lemon peel or nutmeg. If required add sherry, brandy or port wine. Boiling milk may be used instead of water, when no liquor is used.

Thickened Milk.

Boil 1 quart of milk, add a very little salt, and 2 tablespoonfulls of either rice flour, or wheat flour, wet in cold milk. Stir in smoothly, and cook in a double boiler, boiling hard for ½ an hour or more till it thickens. Serve with butter and sugar, or cream and sugar.

Boil it at least an hour, stirring often, if for any patient with digestive trouble.

BEVERAGES.

Chocolate.

Put 2 oz. of chocolate into a double boiler and melt it over the fire. When melted add 1 pt. of new milk, warmed, and 1 tablespoonful of sugar. Cover and boil 5 minutes, then beat the chocolate with an egg beater till smooth. Serve with whipped cream.

Cocoa.

Put 1 pt. of milk in a double boiler. Wet 2 tablespoonfuls of cocoa, with a little cold milk and pour it into the boiling milk, stirring constantly. Stir till it begins to boil, cover the boiler and boil for five minutes. Serve with whipped cream.

Hot Lemonade.

Take 2 lemons. Pare and remove all the white skin and seeds. Cut into thin slices and pour over them 1 pt. of boiling water. Sweeten and drink hot.

Egg Lemonade.

1 egg. Beat white and yolk separately until light, then mix carefully. Take the juice of 1 lemon, add ½ cup of ice water and sugar to sweeten, mix with the beaten egg, add a little cracked ice and serve quickly.

Savory Custard.

Add the beaten yolks of two eggs to 5 cupfuls of beef tea with pepper and salt. Pour into buttered cups and place in a dish of boiling water till the egg is cooked.

Oatmeal Gruel.

2 tablespoonfuls of oatmeal, 1 saltspoonful of salt, 1 teaspoonful of sugar, 1 cupful of boiling water, 1 cupful of milk.

Mix the meal, salt and sugar together, and pour on the boiling water. Cook for ½ an hour. Strain through a fine sieve, add the milk, and heat just to the boiling point. Serve hot.

Scotch Beef Broth.

Add 1 teaspoonful of oatmeal, to 1 pt. of strained and seasoned beef broth, and boil gently for two hours. Keep the quantity of water about the same.

Rice Gruel.

Take 2 tablespoonfuls of ground rice, 1 teaspoonful of cinnamon, 1 qt. of water. Boil 40 minutes and add a teaspoonful of orange jelly.

Corn Meal Gruel.

2 teaspoonfuls of cornmeal, 1 tablespoonful of wheat flour, 1 teaspoonful of salt, 1 teaspoonful of sugar, 1 qt. of boiling water, 1 cup of milk.

Mix meal, flour, salt and sugar with cold water and pour into the boiling water Cook 3 hours.

Crust Coffee.

Toast slices of bread very brown and hard, being careful not to burn them. Cover with boiling water and let it stand well covered till cold. Strain, sweeten if desired, and give as needed cooled with a little ice if liked.

Jelly Water.

1 large teaspoonful of jelly of almost any fruit, beaten into a glass of ice water.

Barley Water.

2 cups of boiling water, 2 tablespoonfuls of pearl barley, washed, 2 teaspoonfuls of white sugar, a little salt.

Soak the barley in a little warm water a short time, and stir it into the boiling water adding a very little salt. Cook gently an hour, stirring often, and strain. Add the sugar last.

Milk Porridge.

1 tablespoonful of corn meal, 1 tablespoonful of wheat flour, 2 cups of boiling water, 2 cups of milk, salt.

Stir the flour and meal to a smooth paste with cold water. Add it to the boiling water, and cook for twenty minutes, add the milk and cook ten minutes longer, stirring often. Eat with sugar and milk while hot.

Milk and Cinnamon Drink.

1 pt. of milk, ½ cup of sugar. Boil with a piece of cinnamon for flavoring.

Taken cold with a teaspoonful of brandy, it is good in cases of diarrhea. For children better warm, without liquor.

Milk Punch.

½ cup of brandy or whiskey to 3 cups of milk, 1 cup of sugar and nutmeg for flavoring. Shake well.

Cream Mixture.

Mix ½ cup of cream with 1½ cups of warm water, add 1 tablespoonful of sugar.

Junket.

Sweeten 1 pt. of milk with ½ cup of white sugar. Heat slightly, pour into a shallow dish, and stir into it 2 teaspoonfuls of essence of rennet. Grate a little nutmeg or powdered cinnamon over it. Serve when cold. In cold weather the milk should be in a warm room to set.

Home Made Lime Water.

Pour 2 qts. of hot water over fresh, unslacked lime (a very small piece), stir till slaked, let stand till clear, then bottle.

Egg Nog.

Scald, not boil, 1 glass of milk. When quite cold, beat an egg into it with a fork with a little sugar. Add a dessert spoonful of brandy or whisky, and fill the glass with the scalded milk. It may be given without liquor.

TABLE OF FOODS GIVING THE WEIGHT (IN GRAMS, OUNCES AND ROUGH MEASURE) OF A "STANDARD PORTION" OF EACH FOOD AND THE NUMBER OF CALORIES IN THAT "PORTION" IN THE FORM OF PROTEID, FAT AND CARBOHYDRATE.

Name of Food.	"Portion" containing 100 Calories Roughly Described.	Wt. of 100 Calories.		Per cent of		
		Grams.	Oz.	Proteid.	Fat.	Carbohydrate.
COOKED MEATS.						
†Beef, round, boiled (fat), 1099‡	Small serving	36	1.3	40	60	00
†Beef, round, boiled (lean), 1206‡	Large serving	62	2.2	90	10	00
†Beef, round, boiled (med.), 1188‡	Small serving	44	1.6	60	40	00
†Beef, 5th right rib, roasted, 1538‡	Half serving	18.5	.65	12	88	00
†Beef, 5th right rib, roasted, 1616‡	Small serving	32	1.2	25	75	00
†Beef, 5th right rib, roasted, 1615‡	Very small serving.	25	.88	18	82	00
†Beef, ribs boiled, 1169‡	Small serving	30	1.1	27	73	00
†Beef, ribs boiled, 1170‡	Very small serving	25	.87	21	79	00
*Calves foot jelly, as purchased		112	4.	19	00	81
*Chicken, as purchased, canned	One thin slice	27	.96	23	77	00
*Lamb chops, boiled, edible portion, average	One small chop	27	.96	24	76	00
*Lamb, leg, roast	Ordinary serving	50.0	1.8	40	60	00
†Mutton, leg, boiled, 1184‡	Large serving	34	1.2	35	65	00
†Pork, ham, boiled (fat), 1174‡	Small serving	20.5	.73	14	86	00
†Pork, ham, boiled, 1192‡	Ordinary serving	32.5	1.1	28	72	00
†Pork, ham, roasted (fat), 1484‡	Small serving	27	.96	19	81	00
†Pork, ham, roasted (lean), 1511‡	Small serving	34	1.2	33	67	00
*Turkey, as pur., canned	Small serving	28	.99	23	77	00
†Veal, leg, boiled, 1182‡	Large serving	67.5	2.4	73	27	00
UNCOOKED MEATS.						
*Beef, loin, edible portion, average (lean)	Ordinary serving	50	1.8	40	60	00
*Beef, loin, edible portion, average (fat)	Small serving	30	1.1	22	78	00
*Beef, loin, porterhouse steak, edible por., av.	Small steak	36	1.3	32	68	00
*Beef, loin, sirloin steak, edible portion, av.	Small steak	40	1.4	31	69	00
*Beef, ribs, lean, edible portion, average	Ordinary serving	52	1.8	42	58	00
*Beef, round, lean, edible portion, average	Ordinary serving	63	2.2	54	46	00
*Beef, tongue, edible portion, average	Ordinary serving	62	2.2	47	53	00
*Beef juice		395	14.	78	22	00
*Chicken (broilers), edible portion, average	Large serving	90	3.2	79	21	00
*Clams, round, in shell, edible portion, average	Twelve to sixteen	210	7.4	56	8	36
*Cod, whole, edible portion	Two servings	138	4.9	95	5	00
*Goose (young), edible portion, average	Half serving	25	.88	16	84	00
*Halibut steaks or sec., edible portion, average	Ordinary serving	81	2.8	61	39	00
*Liver, veal, as purchased, average	Two small serving	79	2.8	61	39	00
*Lobsters, whole, edible portion, average	Two servings	117	4.1	78	20	2
*Mackerel (Spanish), whole, edible portion, av.	Ordinary serving	57	2.	50	50	00
*Mutton, leg hind, lean, edible portion, average	Ordinary serving	50	1.8	41	59	00
*Oysters, in shell, edible portion, average	One dozen	193	6.8	49	22	29
*Pork, loin chops, edible portion, average	Very small serving	27	.97	18	82	00
*Pork, ham, smoked, lean, edible portion, av.	Small serving	36	1.3	29	71	00
*Pork, bacon, smoked, med. fat, edible por., av.	Small serving	15	.53	6	94	00
*Salmon (California), ant. sec., ed. por., av.	Small serving	42	1.5	30	70	00
Shad, whole, edible portion, average	Ordinary serving	60	2.1	46	54	00
*Trout, brook, whole, edible portion, average	Two small serving	100	3.6	80	20	00
*Turkey, edible portion, average	Two small serving	33	1.2	29	71	00
VEGETABLES.						
*Artichokes, as purchased, average, canned		430	15	14	0	86
*Asparagus, as purchased, average, canned		540	19	33	5	62
*Asparagus, as purchased, average, cooked		206	7.19	18	63	19
*Beans, baked, canned	Small side dish	75	2.66	21	18	61
*Beans, Lima, canned	Large side dish	126	4.44	21	4	75
*Beans, string, cooked	Five servings	480	16.66	15	48	37
*Beets, edible portion, cooked	Three servings	245	8.7	2	23	75
*Cabbage, edible portion		310	11	20	8	72

† Experiments on Losses in Cooking Meats. (1900-03), Grindley, U. S. Department of Agriculture, Bull. No. 141.

‡ Laboratory number of specimen, as per Experiments on Losses in Cooking Meat.

* Chemical Composition of American Food Materials. Atwater and Bryant, U. S. Department of Agriculture, Bull. No. 28.

TABLE OF FOODS—*Continued.*

Name of Food.	"Portion" Containing 100 Calories Roughly Described.	Wt. of 100 Calories. Grams.	Oz.	Per cent of Proteid.	Fat.	Carbohydrate.
*Carrots, edible portion, average, fresh........	....	215	7.6	10	8	82
Carrots, cooked...........................	Two servings.....	164	5.81	10	34	56
*Cauliflower, as purchased, average..........	....	312	11	23	15	62
*Celery, edible portion, average.............	....	540	19	24	5	71
Corn, sweet, cooked.......................	One side dish.....	99	3.5	13	10	77
*Cucumbers, edible portion, average..........	....	565	20	18	10	72
*Egg plant, edible portion, average..........	....	350	12	17	10	73
Lentils, cooked...........................	....	89	3.15	27	1	72
*Lettuce, edible portion, average............	....	505	18	25	14	61
*Mushrooms, as purchased, average...........	....	215	7.6	31	8	61
*Onions, fresh, edible portion, average........	....	200	7.1	13	5	82
*Onions, cooked...........................	Two large servings	240	8.4	12	40	48
*Parsnips, edible portion, average............	1½ serving.......	152	5.3	10	7	83
Parsnips, cooked..........................	....	163	5.84	10	34	56
*Peas, green, canned......................	Two servings.....	178	6.3	25	3	72
*Peas, green, cooked......................	One serving......	85	3	23	27	50
Potatoes, baked..........................	One good sized....	86	3.05	11	1	88
*Potatoes, boiled.........................	One large sized....	102	3.62	11	1	88
*Potatoes, mashed (creamed)...............	One serving......	89	3.14	10	25	65
Potatoes, steamed........................	One serving......	101	3.57	11	1	88
*Potatoes, chips..........................	One-half serving..	17	.6	4	63	33
*Potatoes, sweet, cooked..................	Half of av. potato.	49	1.7	6	9	85
*Pumpkins, edible portion, average..........	....	380	13	15	4	81
Radishes, as purchased....................	....	480	17	18	3	79
Rhubarb, edible portion, average............	....	430	15	10	27	63
*Spinach, cooked, as purchased.............	Two ord. servings.	174	6.1	15	66	19
*Squash, edible portion, average............	....	210	7.4	12	10	78
*Succotash, canned, as purchased, average.....	Ordinary serving..	100	3.5	15	9	76
*Tomatoes, fresh, as purchased, average.......	Four av. tomatoes	430	15	15	16	69
Tomatoes, canned.........................	....	431	15.2	21	7	72
*Turnips, edible portion, average............	Two large servings	246	8.7	13	4	83
Vegetable oysters.........................	....	273	9.62	10	51	39
DAIRY PRODUCTS.						
*Butter, as purchased.....................	Ord. pat or ball...	12.5	.44	.5	99.5	00.
*Buttermilk, as purchased..................	1½ glass.........	275	9.7	34	12	54
*Cheese, American, pale, as purchased........	1½ cubic in......	22	.77	25	73	2
*Cheese, cottage, as purchased..............	4 cubic in......	89	3.12	76	8	16
*Cheese, full cream, as purchased............	1½ cubic in......	23	.82	25	73	2
*Cheese, Neufchâtel, as purchased...........	1½ cubic in......	29.5	1.05	22	76	2
*Cheese, Swiss, as purchased...............	1½ cubic in......	23	.8	25	74	1
*Cheese, pineapple, as purchased............	1½ cubic in......	20	.72	25	73	2
*Cream..................................	¼ ordinary glass	49	1.7	5	86	9
Kumyss..................................	....	188	6.7	21	37	42
*Milk, condensed, sweetened, as purchased....	....	30	1.06	10	23	67
*Milk, condensed, unsweetened (evap. cream) as purchased............................	....	59	2.05	24	50	26
*Milk, skimmed, as purchased...............	1½ glass.........	255	9.4	37	7	56
*Milk, whole, as purchased.................	Small glass.......	140	4.9	19	52	29
*Whey, as purchased......................	Two glasses......	360	13	15	10	75
FRUITS (DRIED).						
*Apples, as purchased, average..............	....	34	1.2	3	7	90
Apricots, as purchased, average.............	....	35	1.24	7	3	90
*Dates, edible portion, average..............	Three large.......	28	.99	2	7	91
*Dates, as purchased......................	....	31	1.1	2	7	91
*Figs, edible portion, average...............	One large........	31	1.1	5	0	95
*Prunes, edible portion, average.............	Three large.......	32	1.14	3	0	97
*Prunes, as purchased.....................	....	38	1.35	3	0	97
*Raisins, edible portion, average............	....	28	1.	3	9	88
*Raisins, as purchased.....................	....	31	1.1	3	9	88

† Experiments on Losses in Cooking Meats. (1900-03), Grindley, U. S. Department of Agriculture, Bull. No. 141.

‡ Laboratory number of specimen, as per Experiments on Losses in Cooking Meat.

* Chemical Composition of American Food Materials. Atwater and Bryant, U. S. Department of Agriculture, Bull. No. 28.

TABLE OF FOODS—*Continued.*

Name of Food.	"Portion" Containing 100 Calories Roughly Described.	Wt. of 100 Calories. Grams.	Wt. of 100 Calories. Oz.	Per cent of Proteid.	Per cent of Fat.	Per cent of Carbohydrate.
FRUITS (FRESH OR COOKED).						
*Apples, as purchased	Two apples	206	7.3	3	7	90
Apples, baked		94	3.3	2	5	93
Apples, sauce	Ordinary serving	111	3.9	2	5	93
*Apricots, edible portion, average		168	5.92	8	0	92
Apricots, cooked	Large serving	131	4.61	6	0	94
*Bananas, yellow, edible portion, average	One large	100	3.5	5	5	90
*Blackberries, as purchased, average		170	5.9	9	16	75
Blueberries		128	4.6	3	8	89
*Blueberries, canned, as purchased		165	5.8	4	9	87
Cantaloupe	Half ord. serving	243	8.6	6	0	94
*Cherries, edible portion, average		124	4.4	5	10	85
*Cranberries, as purchased, average		210	7.5	3	12	85
*Grapes, as purchased, average		136	4.8	5	15	80
Grape fruit		215	7.57	7	4	89
Grape juice	Small glass	120	4.2	0	0	100
Gooseberries		261	9.2	5	0	95
*Lemons		215	7.57	9	14	77
Lemon juice		246	8.77	0	0	100
Nectarines		147	5.18	4	0	96
Olives, ripe	About seven olives	37	1.31	2	91	7
*Oranges, as purchased, average	One very large	270	9.4	6	3	91
Oranges, juice	Large glass	188	6.62	0	0	100
*Peaches, as purchased, average	Three ordinary	290	10.	7	2	91
Peaches, sauce	Ordinary serving	136	4.78	4	2	94
Peaches, juice	Ordinary glass	136	4.80	0	0	100
*Pears	One large pear	173	5.40	4	7	89
Pears, sauce		113	3.98	3	4	93
*Pineapples, edible portion, average		226	8.	4	6	90
Raspberries, black		146	5.18	10	14	76
Raspberries, red		178	6.29	8	0	92
*Strawberries, as purchased, average	Two servings	260	9.1	10	15	75
*Watermelon, as purchased, average		760	27.	6	6	88
CAKES, PASTRY, PUDDING AND DESSERTS.						
*Cake, chocolate layer, as purchased	Half ord. square piece	28	.98	7	22	71
*Cake, gingerbread, as purchased	Half ord. square piece	27	.96	6	23	71
*Cake, sponge, as purchased	Small piece	25	.89	7	25	68
Custard, caramel		71	2.51	19	10	71
Custard, milk	Ordinary cup	122	4.29	26	56	18
Custard, tapioca	Two-thirds ordin.	69.5	2.25	9	12	79
*Doughnuts, as purchased	Half a doughnut	23	.8	6	45	49
*Lady fingers, as purchased		27	.95	10	12	78
*Macaroons, as purchased		23	.82	6	33	61
*Pie, apple, as purchased	⅓ ord. piece	38	1.3	5	32	63
*Pie, cream, as purchased	¼ ord. piece	30	1.1	5	32	63
*Pie, custard, as purchased	⅓ ord. piece	55	1.9	9	32	59
*Pie, lemon, as purchased	⅓ ord. piece	38	1.35	6	36	58
*Pie, mince, as purchased	¼ ord. piece	35	1.2	8	38	54
*Pie, squash, as purchased	⅓ ord. piece	55	1.9	10	42	48
Pudding, apple sago		81	3.02	6	3	91
Pudding, brown betty	Half ord. serving	56.6	2.	7	12	81
Pudding, cream rice	Very small servin	75	2.65	8	13	79
Pudding, Indian meal	Half ord. serving	56.6	2.	12	25	63
Pudding, apple tapicoa	Small serving	79	2.8	1	1	98
Tapioca, cooked	Ordinary serving	108	3.85	1	1	98

† Experiments on Losses in Cooking Meats. (1900-03), Grindley, U. S. Department of Agriculture, Bull. No. 141.

‡ Laboratory number of specimen, as per Experiments on Losses in Cooking Meat.

* Chemical Composition of American Food Materials, Atwater and Bryant, U. S. Department of Agriculture, Bull. No. 28.

TABLE OF FOODS—*Continued.*

Name of Food.	"Portion" containing 100 Calories Roughly Described.	Wt. of 100 Calories.		Per cent of		
		Grams.	Oz.	Proteid.	Fat.	Carbohydrate.
SWEETS AND PICKLES.						
*Catsup, tomato as purchased, average		190	6.	10	3	87
*Honey, as purchased	Four teaspoonfuls.	30	1.05	1	0	99
*Marmalade (orange peel)		28.3	1.	.5	2.5	97
*Molasses, cane		35	1.2	.5	0	99.5
*Olives, green, edible portion	Seven olives	32	1.1	1	84	15
*Olives, ripe, edible portion	Seven olives	38	1.3	2	91	7
*Pickles, mixed, as purchased		415	14.6	18	15	67
*Sugar, granulated	Three teaspoonfuls or 1½ lumps	24	.86	0	0	100
*Sugar, maple	Four teaspoonfuls.	29	1.03	0	0	100
*Syrup, maple	Four teaspoonfuls.	35	1.2	0	0	100
NUTS.						
*Almonds, edible portion, average	About eight	15	.53	13	77	10
*Beechnuts		14.8	.52	13	79	8
*Brazil nuts, edible portion	Three ord, size	14	.49	10	86	4
*Butternuts		14	.50	16	82	2
*Cocoanuts		16	.57	4	77	19
*Chestnuts, fresh, edible portion, average		40	1.4	10	20	70
*Filberts, edible portion, average	Ten nuts	14	.48	9	84	7
*Hickory nuts		13	.47	9	85	6
*Peanuts, edible portion, average	Thirteen double	18	.62	20	63	17
*Pecans, polished, edible portion	About eight	13	.46	6	87	7
*Pine nuts (pignolias), edible portion	About eighty	16	.56	22	74	4
*Walnuts, California, edible portion	About six	14	.48	10	83	7
CEREALS.						
*Bread, brown, as purchased, average	Ord. thick slice	43	1.5	9	7	84
*Bread, corn (johnnycake), as purchased, av.	Small square	38	1.3	12	16	72
*Bread, white, home made, as purchased	Ord. thick slice	38	1.3	13	6	81
Corn flakes, toasted	Ord. cereal dish	27	.97	11	1	88
*Corn meal, granular, average		27	.96	10	5	85
*Corn meal, unbolted, edible portion, average		26	.92	9	11	80
*Crackers, graham, as purchased	Two crackers	23	.82	9	20	71
*Crackers, oatmeal, as purchased	Two crackers	23	.81	11	24	65
*Hominy, cooked	Large serving	120	4.2	11	2	87
*Macaroni, average		27	.96	15	2	83
*Macaroni, average, cooked	Ordinary serving	110	3.85	14	15	71
*Oatmeal, average, boiled	1½ serving	159	5.6	18	7	75
*Popcorn, average		24	.86	11	11	78
*Rice, uncooked		28	.98	9	1	90
*Rice, boiled, average	Ord. cereal dish	87	3.1	10	1	89
*Rice, flakes	Ord. cereal dish	27	.94	8	1	91
*Rolls, Vienna, as purchased, average	One large roll	35	1.2	12	7	81
*Shredded wheat	One biscuit	27	.94	13	4.5	82.5
*Spaghetti, average		28	.97	12	1	87
*Wheat flour, entire wheat, average		27	.96	15	5	80
*Wheat flour, graham, average		27	.96	15	5	80
*Wheat flour, patent roller process, family and straight grade spring wheat, average		27	.97	12	3	85
*Zweiback	Size of thick slice	23	.81	9	21	70
MISCELLANEOUS.						
*Eggs, hen's, boiled	One large egg	59	2.1	32	68	00
*Eggs, hen's, whites		181	6.4	100	0	00
*Eggs, hen's, yolks	Two yolks	27	.94	17	83	00
*Omelet		94	3.3	34	60	6
*Soup, beef, as purchased, average		380	13.	69	14	17
*Soup, bean, as purchased, average	Very large plate	150	5.4	20	20	60
*Soup, cream of celery, as purchased, average	Two plates	180	6.3	16	47	37
*Consomme, as purchased		830	29.	85	00	15
*Clam chowder, as purchased	Two plates	230	8.25	17	18	65

† Experiments on Losses in Cooking Meats. (1900-03), Grindley, U. S. Department of Agriculture, Bull. No. 141.

‡ Laboratory number of specimen, as per Experiments on Losses in Cooking Meat.

* Chemical Composition of American Food Materials. Atwater and Bryant, U. S. Department of Agriculture, Bull. No. 28.

INDEX

Black face type indicates relatively full discussion, ordinary type refers to casual mention only.